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FRIDAY, NOVEMBER 13, 1896.

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HONORS TO JAMES HALL AT BUFFALO.

ONE of the noteworthy features of the recent meeting of the American Association for the Advancement of Science at Buffalo was the celebration of the sixtieth anniversary of Prof. James Hall's public service to science as State Geologist of New York. To this event the afternoon session of Section E (Geology and Geography) was devoted on Wednesday, August 26; and many officers and members of the Association withdrew from other sections for the purpose of participating in this memorial meeting. Prof. Hall was present, having crossed the continent from the Pacific slope (whither he had been ordered by his physician a few weeks before for much needed recuperation) to attend the meeting on receiving notice that his presence was especially desired by his friends.

The session was opened by Vice-President Prof. B. K. Emerson, Chairman of Section E., on behalf of the Association and of the Geological Society of America, which united with the parent body during the Buffalo meeting. Prof. Emerson's opening address was as follows:

It was a fortunate coincidence that the Geological Society of America, which swarmed so recently from the larger Association, should have returned this summer for a union meeting in the parent hive. This assemblage is thus made fully representative of American geology and paleontology. This seems fitting when we consider the purpose which has brought us together to celebrate three score years of most arduous and most fruitful official work; nay,

to commemorate a scientific life of almost the Psalmist's span. "The years of a man are three score years and ten." Here by reason of strength they have gone far beyond four score years. We may congratulate the veteran that he has by the mandate of a great State been enlisted for life in this warfare of science, the armor of which has become a part of his very life.

It is a second happy coincidence that the meeting should have been held in this most hospitable city of Buffalo, in the heart of that old 'Fourth District,' where more than half a century ago the foundations of American stratigraphical geology were so broadly and so soundly laid; where the very names of villages were given new meanings and sanctified to geological uses.

It is a curiously interesting illustration of this that, wherever in the world a group of geologists is gathered together, the word Niagara, or Nia-*gar*-a, as our friends beyond the water would call it, would be, perhaps, a little more apt to call to mind the Upper Silurian limestone than the great waterfall and gorge from which the name was taken.

As I came through Albany on my way hither I was shown the house in which, in 1839, a little conference of the geologists of the New York State Survey discussed the proposal from which grew, in the next year, the Association of American Geologists. Of those who made that party only one man remains, besides the master, whose work we celebrate to-day. The American Association for the Advancement of Science grew out of the Association of American Geologists, and we have heard in general session of the little group of the founders of the American Association in the center of which stands, as its first President, James Hall, of Albany.

The Geological Society of America is the sturdy grandchild of the Association of American Geologists, and it is a final happy coincidence that in gathering to commemorate the work of the first President of the Geological Society we should have in the last president of the same Society the veteran geologist of the Pacific coast, the man best fitted to coin into golden words the greetings of us all to the Nestor of the Paleontologists of America and of Europe—James Hall, of Albany. I call upon Prof. Joseph LeConte, of the University of California, President of the Geological Society of America, to speak in behalf of that Society.

Prof. LeConte responded to the invitation of the presiding officer in the following terms:

I am sure that no words of mine are necessary to introduce to you the much-loved, much-revered Nestor of American geology, Prof. James Hall. I am asked to say a very few on behalf of the Geological Society. If it were for any other man I should have begged off; but when it is for him whom we all delight to honor, this is impossible.

Sixty years of unremitting work—of unswerving purpose, directed toward one end, and that the noblest! Is not this the definition of a great work; more of a great life; still more of a great man? Such a work, such a life and such a man are united in the person of James Hall. Surely in an important sense he may be called the *founder* of American geology. Others with him, and even before him, have done good work, for which we are grateful; but he alone not only laid a foundation as others helped to do, but continued for 60 years to build thereon a solid and beautiful edifice. The geology and paleontology of surveyors in his hands thus became an organized, systematic body of knowledge, about which gathered as a nucleus our whole knowledge of American geology.

But I am not here to give an analysis and estimate of his great work. Others

more intimately associated with him can do this better than I. Yet, perhaps, as one of the oldest among you, I may be allowed to give some personal reminiscences of my early association with Hall, touching only such as have had an influence on my own career. I give but two:

In 1850, with Louis Agassiz, and as his pupil, I visited Prof. Hall in Albany, and accompanied Hall and Agassiz on a geological excursion in the Helderberg Mountains. It was my first lesson in field geology. The intense interest developed in my mind by the rambles; the observations, and especially the discussions between these two men, definitely determined my chief scientific work in the field of geology rather than zoology, which, as we all know, was Agassiz's favorite department.

One more reminiscence: In 1856 occurred the meeting of the A. A. A. S. at Albany under the presidency of Prof. Hall, a meeting memorable for its enthusiasm. At this meeting Dana gave his epoch-making address as retiring President on the development of continents. At the same meeting I gave my first scientific paper showing how barrier reefs are formed on the coast of Florida without subsidence. But with this I am not not concerned. In 1857 the A. A. A. S. met at Montreal, and Hall as retiring President gave his memorable address on the formation of mountains by sedimentation. I can never forget the impression produced. The idea was so entirely new, so utterly opposed to prevailing views, that it was wholly incomprehensible even to the foremost geologists. There was no place in the geological mind where it could find lodgment. It was curious to observe the look of perplexity and bewilderment on the faces of the audience. Guyot was sitting immediately behind me. He leaned forward and whispered in my ear: "Do you understand anything he is saying?" I whispered back, 'Not a word.' And yet the seed sown in that address has borne abundant fruit among American geologists. The views foreshadowed and imperfectly presented then by modification and classification have developed into what has been called the American theory of mountain formation. Whatever of fruitful work I have myself done in this direction I owe to the seed planted then.

I have spoken thus far of Hall the geologist; now a single word, in conclusion, of Hall the man. Greater than all the results of science is the true spirit of science which accomplishes these results. So, greater than all Hall's work—great as this is acknowledged to be—is the character of the man, and the man himself. Hall is an example to us all in his unswerving, incorruptible, self-sacrificing devotion to pure science for its own sake. In this age of profitable science, and even often of science for profit, we cannot too highly value such an example. But if the man determines the character of the work, the work also reacts to determine the character of the man. A great man is necessary for a great work, but a great work continued through life reacts to ennoble and elevate the man, and even illumines the face with a higher intellectual and moral beauty. As Dante, while gazing steadily on ideal beauty in the face of the divine Beatrice, is drawn upward to the seventh heaven, even so the man of science, gazing steadily on the face of Truth, is drawn upward to higher and higher planes of intellectual and moral elevation.

Deeply moved by the expressions of his associates, themselves among the older geologists of the country, Prof. Hall responded briefly and modestly, acknowledging his indebtedness to contemporary investigators for much of the success which has attended the Geological and Natural History Survey of New York for many years,

and expressing full appreciation of the honor shown him by this meeting.

The two more formal papers, which follow, were then presented.

JAMES HALL, FOUNDER OF AMERICAN STRATIGRAPHY.

Sixty years ago the budding science of geology received an impulse by which it was started toward the front rank of the sciences. This impulse was a well-considered enactment authorizing a survey of the geology and natural history of the Empire State. Although it was not the first State Geological Survey in the country, this scientific survey was among the pioneers, was more broadly planned and brilliantly executed than its predecessors, and has long outlived its successors during the same generation. So in the light of events it seems just to say that the Geological and Natural History Survey of New York was the model by which other official institutions for research concerning resources were shaped, the exemplar by which the statesmen and savants of the country have been inspired and guided.

The institution of this survey of New York marked an epoch in the development of American science. The sumptuous series of tomes by Torrey and DeKay, Beck and and Emmons, Mather and Vanuxem, Conrad and Hall and their associates, and the continuation of the series by Hall, are prominent among the classics of the New World. Fortunately, too, the treatises are well known; under an admirably sagacious policy the lawmakers made liberal provision not only for printing, but for distributing the results of the investigations; thus the noble books emanating from the Survey passed into the hands of citizens and found their way into libraries in other lands, as well as throughout this country, where they stirred emulation to the benefit of many States. Through the diffusion of knowledge concerning her resources, these documents contributed much toward the enrichment of the Commonwealth; and through the diffusion of exact knowledge and sound method they enriched science and the Nation. So the delver among rocks, who works for human weal, may well pause to pay a tribute to the New York pioneers who laid the foundation for scientific agriculture and entomology as well as for paleontology and stratigraphic geology, and at the same time aided in the making of botany and zoology in this country.

One of the side issues springing from the institution of the New York Survey is especially significant to members of the American Association. As the surveys progressed it was found desirable to arrange for conferences among the geologists; and when similar surveys were confronted with scientific problems in Pennsylvania, New Jersey, Virginia and other States, conferences among surveyors were found increasingly useful. So in 1840 the geologists at work in these States united in an 'Association of American Geologists;' and in 1841 the same geologists, with their confrères in natural history, reorganized themselves into a society under the name 'Association of American Geologists and Naturalists.' In September, 1847, this body 'agreed to resolve itself into the American Association for the Advancement of Science.' Thus the present National organization for the advancement of science originated in the semi-annual conferences among the New York geologists, and may (at least in part) be reckoned among the results flowing from the impulse given to American science by the statesmen of New York in 1836.

When the official Survey was organized in July, 1836, special prominence was given to the geologic work; and the State was divided into four districts, assigned respectively to William W. Mather, Ebenezer Emmons, Timothy A. Conrad and Lardner

Vanuxem, James Hall being Assistant Geologist. Within a year the districts were redefined and the assignments were changed by appointing Mr. Conrad Paleontologist, transferring Mr. Vanuxem to the Third District, and placing Mr. Hall in charge of the work in the Fourth District.* These assignments were continued until the primary survey was completed and the four formal reports on geology were prepared for publication. Subsequently other assignments were made, including the transfer of Hall to paleontology; and this work was continued, with minor modifications in the law, and remained constantly in charge of the vigorous geologist of the western district from the middle of the fourth decade to the middle of the ninth decade of the century. So this summer is the sixtieth season of the work of Prof. James Hall as Geologist and Paleontologist in charge of the Surveys in New York. This period of State service in behalf of science is beyond all parallel in the annals of geology in America, if not in the world. One of the pioneers in American earth science, a student in the days of William Smith, Rhoderick Murchison and other makers of the science, Hall has survived his early scientific associates, even the contemporaries of his prime, and remains the sole representative of the first generation of American geologists. Growing up, as he did, among the first Western readers of the great stone book, and continuing, as he has, down to the present day in active research, Hall's biography is the history of American geology.

While his contributions to the science of geology have been many and varied, certain lines of Prof. Hall's work are prominent; among these his work in stratigraphy and nomenclature, his contributions to paleontology, his researches concerning the principles of deformation, his work in geologic mapping, and his contributions to knowledge of economic resources, are especially noteworthy.

It is not easy, even if it were needful, to distinguish Hall's work in stratigraphy and nomenclature from that of his early associates; it suffices to observe that it is in the Fourth District especially that the 'New York System' has been found so clearly defined and justly applied as to survive the changes due to later research; though one who has had occasion critically to study all of the New York reports, for the purpose of platting the recorded observations on a geologic map, may be permitted to say that the voluminous report on the Fourth District is notable as bearing on every page inherent evidence of accurate and comprehensive work. Time has shown the wisdom of the founders of the 'New York System.' The definition of formations was a singularly successful application of the principles developed by William Smith in England, and many of the major and most of the minor divisions recognized in 1837–43 are accepted to-day. Other classifications of rocks came into vogue, both earlier and later, yet they have not endured, while that of New York, especially that of the western district, has been tried and found not wanting. The nomenclature adopted was equally happy. Half of the names applied in the western district are in current use, and there is reason for opining that, as detailed surveys are completed, more than half of the others will be revived. Thus, although the term 'New York System' has dropped out of use save in descriptive sense, while the 'Ontario division' is forgotten, and while the 'Champlain division' and 'Erie division' have been abandoned and the names re-employed in other connections, the Trenton, Utica, Hudson River, Oneida, Medina, Clinton, Niagara, Onondaga, Oriskany, Schoharie, Marcellus, Hamilton, Tully, Genesee, Port-

* [Second Annual Report of the New York Geological Survey,] Assembly Document 200, 1838, p. 2.

age and Chemung are familiar terms, in constant use among the geologic workers and teachers throughout eastern United States. Other systems of nomenclature have come and gone; the brilliant and attractive, yet essentially procrustean, system proposed by the Rogers brothers for a time competed with the system devised in New York; but no other system has endured the test of time. Yet the trite statement that the New York formations and formation-names have been found so acceptable as to outlast the many transformations in the growing science does scant justice to the New York work. The chief merit in the New York method resides in the principles recognized, and these principles have not only been adopted in New York and neighboring States, but have extended throughout the country, and indeed have shaped American geology. The New York formations were defined by fossil contents, as were those of England and the Continent, while the nature and genesis of deposits were given greater weight than before; and this method has been followed more or less closely by the geologists of the world engaged in researches among clastic rocks. Most of the New York formations were named from geographic features so chosen as to indicate type localities and to permit endless rearrangement of the duly labeled rock divisions as research progressed and other divisions were recognized; and this system of nomenclature, which was practically original in the New York Survey as applied to minor divisions in geologic column, stopped not at the boundaries of the State, but has spread over the country and the world, and is to-day the accepted system of civilized lands. It might be invidious to claim that any one man originated the method of defining and naming formations now in general use; but it is not too much to say that the method was established by the New York Survey, and that it finds its best illustration in the classic Fourth District; here it was that American stratigraphic geology was founded.

Of Hall's work in paleontology, paleontologists must speak; yet the geologist may well note in passing that it was in New York, and especially by the veteran scientific officer of that State, that the geologic use of fossils was first and most completely established for the western hemisphere. A hundred men of genius have found in fossils a key to the past history of life on the earth; others, like Walcott and White and Neumayr and Barrois and a score of contemporaries, have followed the method devised by William Smith and applied by James Hall, and have thereby unlocked the treasure-house of earth's resources.

It is sometimes forgotten that, though Hall was officially transferred to paleontology a full half century ago, his geologic work was continued. Without severing his connection at Albany he availed himself of opportunities for researches in other parts of the country and in the neighboring Dominion of Canada; his work in Wisconsin was especially extended, while in Iowa he organized and carried to successful completion a State Survey which was long the standard for the Mississippi Valley. Partly through these researches in other regions, partly through the New York work, he fitted himself to deal with problems of dynamic geology, and to this subject he made important contributions in papers and addresses and through conferences with fellow students. One of the most noteworthy of these contributions, first stated in his presidential address before the American Association for the Advancement of Science in 1856, was the inference that loaded areas of the earth-crust sink at a rate conditioned by the rate of loading. This noteworthy inference was formally enunciated and discussed in the introduction to the third volume of the reports on

the paleontology of New York. While Babbage, Hopkins, Herschel and other Britons previously discussed the mobility of the earth-crust, and while Powell later made the correlative discovery that mountainous areas rise with unloading and Dutton still later formulated the doctrine, this publication by Hall was one of the most important contributions ever made to the doctrine of isostasy.

One of the early publications of the New York Survey was a preliminary geologic map of the State. Portions of this map (particularly the western portion, or Fourth District) may be characterized as accurate to scale, and up to the geographic knowledge and cartographic methods of the times; other portions (particularly the complex districts of the east and north) were far from satisfactory. When Hall assumed charge of the entire geologic and paleontologic work of the State he planned to revise the early cartographic work and to issue a map comparable with the splendid quarto volumes in accuracy and dignity. Many obstacles stood in his way; the State was practically unsurveyed, so that there was no trustworthy basis for the geologic mapping; the structure, especially in the eastern and northern districts, was intricate and obscure; extensive areas were so deeply covered by Pleistocene deposits as to conceal the substructure which he desired to represent; the means at disposal were limited; and from time to time official obstacles, which need not be stated in detail, arose to prevent the execution of his plan. So the months grew into years and the years rolled into decades, and his ambition remained unfulfilled. About ten yerrs ago a number of detailed surveys were brought to completion, an urgent demand for a geologic map of the Empire State had arisen, and the plan seemed about to mature. At this stage Prof. Hall sought the cooperation of Major Powell, then Director of the Federal Survey, and a cooperative plan was adopted, under which it fell to me to aid in the work. Unhappily the difficulties in the way of mapping the formations of the State were by no means overcome, and once more the months grew into years, which rolled into another decade before the ambition of the veteran officer was even partially gratified. First it was found necessary to examine and reduce the records accumulated during fifty years; then field studies in type localities were required in order that the records might be interpreted; next it was found that the base maps were wholly inadequate. So the geologic mapping was suspended and a base map was compiled from the best available sources; then the geology was revised and duly transferred; with every operation the standard of accuracy and general excellence rose, and it was found that in many districts geologic knowledge was insufficient to warrant mapping on the scale adopted. Thus fresh surveys were required; and many days were spent in company with Prof. Hall in reconnoissances and surveys in the Mohawk Valley and about the southern flanks of the Adirondacks, and I can never forget the vigor and determination with which the octogenarian geologist pushed over the rugged hillsides, sometimes plowing through snow and wading through floods, in the hope of raveling complex relations among the rocks. Many others were enlisted in the work. Kemp, Merrill, Smythe, Clarke and Beecher, and, especially toward the last, Darton, made important contributions; with the aid of these and other collaborators the map was finally brought to such state of completion as to warrant issue. A small proof edition of the map was printed early in 1896, through the courtesy of Hon. Charles D. Walcott, Director of the Geological Survey. No one can be more painfully aware than the compiler of the many imperfections of

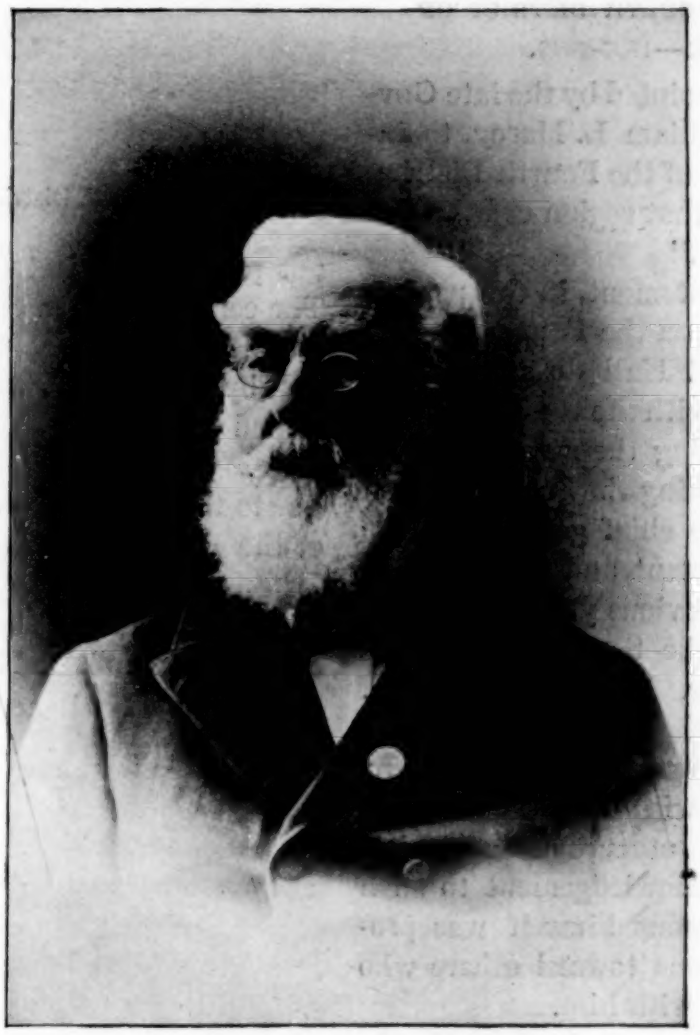
the map; the colorless areas are an eyesore to worker and teacher, and even more trying to the conscientious student are the minor inconsistencies in classification and the local inaccuracies in the tracing of boundaries. While the map is incomplete, it seemed to its real author, Prof. Hall, best to issue it as a stimulus and guide for future research, and in this view most of the citizens of the Empire State will doubtless coincide. The map is noteworthy as representing the fruits of an unprecedented period of labor, and as marking the fruition of an ambition outlasting the average span of human life.

JAMES HALL—1843.

Although engaged primarily in scientific research, the veteran State Geologist of New York never forgot the original demand of statesmen for practical knowledge whereby resources might be developed; and quarry rocks and clays, iron and cement, salt and petroleum, and many other natural sources of wealth, were conscientiously examined by him or under his direction. This part of the work of the State Survey can better be treated by others; it must suffice for one who looks on from outside the State to express the opinion that the great Commonwealth has been materially enriched through the sixty years of unremitting labor by the State Geologist.

It is not easy to characterize a man still in vigorous life without flattery and without derogation; yet it is possible to char-

acterize a great work without fear or favor. The science of geology, as now accepted, is a scant century old; there is one among us who has contributed constantly to its progress during two-thirds of that period. American geology has come up in two-thirds of a century and has become a far-reaching science whose ramifications extend to many industries and contribute much to national welfare and human pleasure; there is one among us whose hand has stayed not from the beginning to the present. The development of earth-science has been due to the genius and devotion of many men, often for years, sometimes for decades, seldom for half centuries; there is one among us who has nearly reached the Psalmist's span in continuous work for the science. Many of the geologists who honor this occasion with their presence are hoar with time and bent with weight of years; there is one among us who laid the foundation for our work before most of us were born. Some of the men who have made geology are known at home as benefactors; others, like the prophets of old, are not without honor, save in their own country; a few have come to be known by their works at home and abroad; there is one among us who is



JAMES HALL—1891.

known wherever the language of science is spoken, who is honored in his State, revered in his friendly circle, and esteemed in far countries—he is the founder of stratigraphic geology and applied paleontology in America, James Hall. W J McGee.

Bureau of American Ethnology.

Professor James Hall and the Geological Survey of the Fourth District of New York—1837-1843.

"Having been appointed by the late Governor, the Hon. William L. Marcy, to investigate the geology of the Fourth District, * * * my duties in that region commenced in the spring of 1837."

In making this statement, in the preface of his final report upon the Fourth District of New York, Prof. Hall does not mention any connection with the Geological Survey of the State during the season of 1836. Under the law governing the Survey as then constituted, the four chief geologists were each allowed an assistant, and Mr. Hall had served during the previous year in the Adirondack region of the Second District as the assistant of Dr. Ebenezer Emmons. Strangely enough, there is, I believe, no reference in Dr. Emmons's reports to Mr. Hall's cooperation with him in this capacity, although the other chief geologists rendered public acknowledgement to such assistants and Emmons himself was profuse in his expressions toward others who had been associated with him.

Reference is made to these facts simply to show that Professor Hall's activity during his first season of official life, sixty years ago, is virtually unrecorded.

This circumstance, however, was not, I am convinced, in any way, directly or indirectly, the occasion of his promotion in the following year to the position of Chief Geologist.

The original apportionment of the four geological districts as made in 1836, had

Fig. 1. Geological Districts of New York. 1836.

not proved satisfactory to the geologists. The central-western extension of the State had been divided as nearly as possible in half by an east and west line which maintained the integrity of the county boundaries. This division was unquestionably due to the influence of Prof. Amos Eaton, of the Rensselaer School at Troy; for Prof. Eaton himself, aside from the power he wielded in the creation of the Survey, had already reconnoitered this unexplored region

Fig. 2. Geological Districts of New York. 1837.

in his geological survey of the country adjoining the Erie Canal, had demonstrated the latitudinal outcrops and easy succession of the formations, and in pursuance of his suggestions the line of division was so drawn

that the geologists of the respective districts should each have the fullest possible representation of different parts of these formations, to the one the lower, to the other the upper part. To the Fourth District was given a single full section of the rock series from Lake Ontario to the Pennsylvania line by including within it the counties of Niagara and Erie.

The division was certainly a philosophical one with the knowledge then at hand, but the geologists of this part of the State, Vanuxem and Conrad, had found, from their first season's work, the disadvantages of independent observation in an unknown field, and the importance of opportunities for comparison of results from different meridional sections of the same formations. Moreover, Conrad, who had been assigned to the Third District, which covered an area richer far than any other in the State in extinct organisms of beautiful preservation, had become enamoured of them. A zoologist before he was a geologist, his own preferences were consulted when, upon recommendation of the geologists, he retired from the field to become the Paleontologist of the Survey.

Conrad thereafter became the fifth wheel of the geological equipage; it could not turn without him; but when the work was done according to the statutory requirements he felt that his part of it was hardly begun. As he left for Philadelphia with the remark, "If I were to work a hundred years I could not describe the fossils of New York," he left behind a magnificent opportunity.

Dr. Emmons, also, was not wholly satisfied with the boundary of his district, and wished to have Jefferson county included within it. Thus at the opening of the season of 1837, the First District alone retained its original extent, Lieut. Mather in charge. Emmons's district (the Second) was enlarged by the addition of Jefferson county, the Third and Fourth Districts were remodeled by dividing them with a north and south line passing through Cayuga lake, observing county lines, except in the case of Tompkins county, which was cut nearly in half. Vanuxem, who had the previous season been in charge of the old Fourth District, was transferred to the new Third, and Mr. James Hall, former Assistant Geologist, was made Chief Geologist in charge of the new Fourth District.

Mr. Hall was then a young man, just past his twenty-fifth year, a very young man for so responsible an undertaking, and, as I have often heard him say, he was not allowed to forget the fact. Between this young man and the new conditions by which he was surrounded there was a happy adjustment that led to the production of the exhaustive and superb report on the Fourth Geological District, a work which, in philosophical treatment, in content and in its influence upon geological science has but few equals among works of this character.

The merit of this report must not be ascribed, to any large degree, to the simplicity of its subject. It had, indeed, so happened that the geological structure of this division of the State was the least complicated of them all. It presented no obscure problems of succession, no crustal disturbances, no intricate topography. From bottom to top the formations follow with the regularity of tiles upon a roof; the water courses, the lake basins, the sculpturing of the highlands, all evidence the most uniform submission to fundamental law; indeed, it would be difficult to find another region of equal extent upon these older rocks from which nature has so unequivocally banished all complicated problems.

The simplicity of the problems undoubtedly rendered the results more easy of acquisition and left to the distinguished chief more abundant opportunity for the accumu-

lation of detailed information than fell to the fortune of his colleagues further east who had some difficult knots to untangle.

I have read the report on the Fourth Geological District of New York more often, with more assiduity and precision than I have read any other geological book. I have studied it for information, for guidance in the field during nearly twenty years. I have perused it critically, purposely blind to its merits and alive to any discrepancies, shortcomings or errors; and I have, too, endeavored to read it in the spirit which dictated it. To-day I do not hesitate to say that I know no other work of this character so distinguished for its fidelity to the facts, so strongly stamped with accuracy of observation. The work begun by Prof. Hall in this region fifty-nine years ago stands to-day squared with the truth as it stood fifty-three years ago, when his final report was rendered.

In 1837 western New York was only a sparsely settled country. It had already, indeed, centers of civilization. Buffalo was its most populous point; Rochester was a rapidly growing town, and there were various thrifty villages dotting the valley lands. Their population had been drawn very largely from the New England towns; the Phelps and Gorham Company, and the Holland Company, whose lands included nearly the whole of the region, had attracted purchasers of a superior class; the country north of the Helderberg escarpment, in the lake region, and in the fertile valleys, had become stippled with enterprising settlements, which were increasing in size and number under the influence of the chief highway, the Erie Canal. But away from the lowlands, over the high intervales of the central area and the broad plateau covering the southern half of the district, the region was largely a virgin wilderness. These circumstances were, no doubt, contributory to the simplicity of the geological problem, for it was in the low lands, those which civilization had taken possession of and rendered comfortably accessible, that the greatest number of distinct geological formations were present; the Medina, Clinton, Niagara, Salina, Corniferous, Waterlime, Marcellus and Hamilton; while the highlands, the wilderness covering more than one-half the area of the district, proved to belong almost wholly to the two divisions, Portage and Chemung.

It is not my intention to pass in review the geological determinations of Prof. Hall in this district; they are too well known. The great value of the results attained lies, as I apprehend it, in the stable, indestructible foundation upon which they placed a large portion of the paleozoic succession. Let the geologist now approach it from any quarter, whatever the position, whatever the lever, he will labor in vain to overthrow or disturb these foundations of the geological edifice in New York. The work was not done for a day, but for all time. Upon this foundation workers of to-day must build. Other foundation can no man lay.

No one has contributed so much to the superstructure as has Prof. Hall himself. The study of this great series of fossil-bearing rocks during his six seasons in the field aroused in him a conviction of the preeminent importance of a knowledge of extinct organisms as a means of substaniating strictly geological evidence. "The New York geologists have made out a classification of their older rocks," said Sir Charles Lyell; "let them now prove the truth of it by means of their fossils." It was for this very end, to prove the validity of the New York Series that Prof. Hall, upon the close of the Fourth District survey, sought and obtained encouragement to carry forward purely paleontological studies, with results of surpassing value. To the survey of the Fourth District we must

ascribe the chief stimulus in the production of the 'Paleontology of the State of New York.'

Through these investigations and in many collateral channels he has amplified and augmented the results of his original survey.

It is not to be thought that he ever regarded his work in this region completed with his reports, for those here who have known him best will bear me out in the statement that no man of science is more open to conviction, to the correction of his own observations if evidence shows them to be imperfect; he was always strong to maintain his conception of the truth, but ready to yield if the facts were against him or to modify his conclusions, if needful, with the acquisition of new data.

Not long ago we completed a somewhat exhaustive treatise on the Brachiopoda. It had been the consecutive work of nearly seven years. Very extensive collections had been at the disposal of the work; every effort had been made to bring together the sum of knowledge pertaining especially to the paleozoic genera of these most significant organisms. When the last proofs of the last quarto volume had been read, Prof. Hall made this remark to me, "We have labored very hard on this book and have brought out some knowledge that will be useful to the scientific world, but, for my part, I feel that I would now like to *begin* the study of the Brachiopoda."

Thus in all his lines of activity no work is finished; it may be done for the present and laid aside in hope of a return thereto, or taken as preliminary to the upbuilding of a more elaborate superstructure.

To-day, with sixty years behind him of service to the geology of New York, no one can realize as he the vast amount of work yet remaining, requiring prime abilities and the best equipment.

Our conviction of the great success of this survey is not lessened by the fact that Mr. Hall's colleagues were men of high accomplishments, careful training and a larger professional experience than he. Lieut. Mather, a West Point graduate, had been with Featherstonnaugh on his western survey. Dr. Emmons had learned and taught mineralogy and geology both at Troy and on the complicated rocks of Massachusetts, and possessed an admirable equipment for combatting the difficult problems presented by the Second, or northern District; Lardner Vanuxem, after receiving a technical training in the schools of France, had done no little geological work in the Ohio valley and elsewhere. I have heard him characterized by one who knew him well as at this time the most proficient geologist of the country. He certainly was a most acute observer, and the value of his work in the Third District is becoming constantly more evident.

Mr. Hall, but four years before the organization of the Survey, had emerged from the Rensselaer school at Troy and the inspir- tutelage of Prof. Eaton. In the interval he had been associated with Prof. Eaton and Dr. Emmons in teaching geology and mineralogy as well as chemistry and physiology at this school, and had acquired the good will of both Prof. Eaton and Mr. Stephen Van Rensselaer, whose influences in the organization of the Natural History Survey were paramount.

It is an interesting fact that Prof. Hall was the only one of the geologists to seriously attempt a correlation of the New York formations with those of Europe as they had been described by Murchison and Sedgwick. It was, indeed, too soon for any such attempt to be successful and, though it was made only as a corollary to his elaborate descriptions, it seems a most natural undertaking for a student of Prof. Eaton, who had employed, perforce perhaps but often perfunctorily, such classi-

fications of the rocks as had emanated from the European geologists. But it was emphatically the chief business of the geologist to make a classification of the New York rocks independent of any correlation with the formations of other countries or other States, and the New York column, as they erected it, is constantly achieving new importance, a perpetual memorial of their accomplishments and a monument to their patriotic pride.

All of the four geologists found subsequent opportunity to test the validity of their conclusions in other States. Vanuxem had, indeed, undertaken such a correlation before the survey opened; but of them all, chiefly Prof. Hall, who, beginning his correlation during the period of his work in this district, has done more than any other to find in the geological structure of other States of the Union corroboration of the work done in New York and to extend its influences over them.

We should not, on this occasion, omit at least a passing reference to the aid rendered in the survey of the Fourth District by the assistants during the various seasons of work. These were Dr. G. W. Boyd, who died before the work was completed; Prof. E. S. Carr, of the Medical College at Castleton, Vt., and especially the late Prof. E. N. Horsford. Prof. Horsford had been raised among the Seneca Indians of western New York, his home being at Moscow, near the center of the Fourth District. He had graduated from the Rensselaer School in 1838, and the season of 1839 was spent on the Fourth District survey. Although this was the only season of his official connection therewith, he had, while still a student at Troy, aided Prof. Hall by conceiving and executing the ingenious geological contour map of the Genesee valley accompanying the first report on this district. To his intimate acquaintance with this region much of our knowledge of the important Genesee section is doubtless due. Throughout all the upward course of later years this eminent man remained, until the end of his life, at all times the cordial friend and active supporter of the Geological Survey of New York.

It is fitting, too, that we again observe here the influences inspiring these official investigations which emanated from the Rensselaer Polytechnic Institute, at Troy. Van Rensselaer himself, from his own pocket, promulgated the first extended geological exploration of the State; the inspiring Eaton, who had delivered, by request, lectures on geology to the Legislature of New York and had even set Governor DeWitt Clinton to collecting fossils, not only promoted the work in all ways, but made it possible by furnishing the right sort of men to do it. Emmons and Hall; Horsford and Carr, of the Fourth District, and Briggs, of the First District, were all pupils of his. And it is a pleasure to refer to the fact that the influences of this famous institution upon the geology of New York are in renewed evidence. The Hon. T. Guilford Smith, of Buffalo, President of this Library Association, a Regent of the University and the chairman of its committee on the State Museum, is also a graduate of the Troy school.

The geological survey of the Fourth District has never been completed. To its determinations there is a constantly growing increment of facts, and from them problems of great interest are ever rising. Now and again novel and important forms of organic life show that we have not yet fathomed the wealth of its sediments, in evidence of which stand the sixty or more species of silicious hexactinellid sponges from the Chemung group, nearly all of which are the discoveries of the last few years. A fauna described by the Canadian geologists, but barely known in this State, the Guelph fauna, has been recently shown by Mr. A.

L. Arey to exist here in a well defined development.

The exploitation of the Lower Helderberg, a typically eastern New York formation and fauna, through this western district, brings out much important knowledge as to its relations with the under and overlying faunas, and this region will play an important rôle in the determination of serious questions bearing upon the geological age of the Lower Helderberg group and the integrity of the New York Series.

The Portage group also presents a number of interesting problems. Its fauna in the original sections is an exotic one, the most complete replica, in the American paleozoic rocks, of an European fauna. It may almost be said that here in New York it had neither predecessors nor successors. But eastward in the State the fauna changes, and Portage time is represented by a rock series whose fauna has nothing in common with that in typical Portage sections, but which has been derived, and, indeed, is often difficult to distinguish from the Hamilton fauna, which preceded it. And within the same time element further east, a portion of this fauna is again replaced by the meager, shallow and brackish water fauna of the Oneonta beds. Along such lines as these pertaining to the historical geology and the evolution of the life of the Fourth District, the labors of Prof. Hall have been followed by those of Professors Henry S. Williams and Charles S. Prosser, whose results have been most suggestive and important; and others have cooperated in the increase of this knowledge, Prof. S. G. Williams, Luther, Ringueberg, Lincoln, Bishop, Mixer, Harris, Pohlman, Grote, Pitt and some others.

The facts recorded in the report of this District concerning its surface contour, the later changes of topography, the distribution and mode of accumulation of superficial deposits, the presence of buried valleys, and other data especially inviting the glacialist and geomorphist, are in suggestive abundance, and it is no wonder that remarkable and beautiful results have been obtained from this region during the later rapid growth of these special lines of geologic research. Witness the work of Gilbert, Spencer, Dryer, Fairchild, Taylor and Leverett, and that old geological clock, Niagara Falls, which has been the center of such many-sided discussion. The elaborate account of it, its topography and changes, published by Prof. Hall, in 1843, has been regarded as of such fundamental value that, more than fifty years afterward, it is reprinted in its entirety by another department of the State government.

We have come to a period in the history of geologic investigations in the old Fourth District of New York where nice questions bearing upon the significance of variations in faunas, their origin, dispersion, taxonomy and chronology are pressing to the front. Their solution may involve the weakening of the conventional division lines upon which we have so long depended, but which are only confessions of faulty knowledge. In the study of such questions the labors of Prof. Hall have given to the State of New York a supreme advantage. Only with their solution will come accurate geologic maps and a precise knowledge of our geology.

As we are accustomed to look back into these paleozoic faunas for initiatory types of organic life whence depart into the later history of the earth a multitude of diverse organic expressions, so we find in the original survey of the Fourth District the kernel of all later work along the lines indicated, the suggestion of the completed geology of the State of New York.

ALBANY, N. Y. JOHN M. CLARKE.

Prof. Clarke's address was illustrated by various maps, particularly the two sheets

reproduced above showing the primary and secondary districting of the State by the Geological and Natural History Survey in 1836 and 1837. He also exhibited an early daguerreotype of Prof. Hall, long forgotten by its living original and only accidentally discovered, in which the strong features of a vigorous prime were revealed for the first time to most of those participating in the meeting. This daguerreotype, together with a recent photograph, is reproduced above.

Hon. T. Guilford Smith, of Buffalo, a Regent of the University of New York, addressed the meeting on behalf of the State and the University, as follows:

I thank you very heartily, Mr. Chairman, for calling upon me on this occasion, and allowing me to join with others in the congratulations to Prof. James Hall, our State Geologist, one of the oldest and most distinguished of his profession.

I am particularly pleased to have this opportunity because Prof. Hall graduated from the Rensselaer School in 1832, and is one of the oldest, if not the oldest, of its living graduates. This school he has ever regarded with profound affection and respect, and as his reputation grows he is pointed out by its authorities as an example for us all to emulate. When I remember that this gentleman graduated from this school before I was born, and is to-day in the active practice of his profession, and with faculties unimpaired, it seems almost incredible. As every alumnus looks with more or less affection on distinguished graduates of the same Alma Mater, I may be pardoned in indulging a justifiable pride in Dr. Hall's success, from the fact that I graduated from that school in 1861, many years later.

It was somewhat at the suggestion of Dr. Hall that, in 1890, I was elected a Regent of the University of the State of New York, and in 1891 (through the favor of the late Chancellor Curtis) was made chairman of the State Museum Committee. This committee had charge, at that time, of the scientific work of the State, and I had many opportunities of meeting Prof. Hall, and of being made thoroughly aware of his ceaseless activity and ability to do two or three men's work.

In this connection, after much deliberation, Dr. Hall finally consented to the publication of the new geologic map of the State, a copy of which he was good enough to send me recently, and which I have hung upon the walls of this Society; there it is. I hope it may remain there, with your permission, Mr. Chairman, in commemoration of this meeting, with some suitable inscription, stating that it was presented to the Geologic Society, and by them deposited with the Buffalo Society of Natural Sciences, in commemoration of this meeting.

Please examine this map closely. Dr. Hall does not claim it is perfect, and forbore publishing it for many years in order to improve it and to increase its accuracy. You will notice on the map that there are many spaces perfectly white and left entirely plain. These, as Dr. Hall has stated to me and to others, are suggestions to his collaborators, and to those who come after him, of the necessity of further work before a final and complete geologic map of the State of New York can be had.

The map which preceded this, and which, you may remember, was a very different affair, served its purpose at that time; yet Dr. Hall felt that, in deference to the work that had been done since, any map which bore his name, and which was issued by the authority of this State, should embody all that has been found out since.

In the work connected with his high office, Dr. Hall has surrounded himself, in the many years of his service, with many

men whose names are well known in scientific research, some of the older of whom have passed away, but leaving a record of which their descendants may well be proud. Others, who are now in active life, and in the practice of their profession, do not hesitate to speak gratefully of the instructions received under him when serving on his personal staff. In fact, up to 1849, when the Rensselaer School became the Rensselaer Polytechnic Institute, it was the only school especially devoted to the study of natural history in the United States, and it is with much pride that we all look up to it as a pioneer in this direction; and while it has broadened its field it still devotes a very considerable part of its curriculum to study of the natural sciences, and has had for many years in its faculty Dr. James Hall, as Emeritus Professor of Geology.

It was not only in connection with scientific research, and the work and study connected with the examination of field notes, and the proper recording of them, which earned for the State Geologist a great reputation, more particularly in the early days. Dr. Hall was one of the pioneers in this respect. It was necessary not only that this work should be done, and should be put in proper shape, but that the people at large, and particularly the Legislature, should be thoroughly convinced of the importance of the work done, and the necessity of printing the same for general distribution.

When one looks at the long array of volumes devoted to the geology and paleontology of this State, and which have been published by this Commonwealth at a cost of over a million and a half of dollars, anyone will say that Dr. Hall needs no other monument. He is the most successful of all scientists in obtaining appropriation for this purpose, and it may be well doubted whether any successor to him, no matter how young, how active, how efficient and how distinguished, will ever be able to equal him in this respect. I may be pardoned for dwelling upon this part of Dr. Hall's record, because many of the younger men do not know of these difficulties. In some of the States the State Geologist's reports go to the State Printer, as a matter of course, and are printed and distributed; but it was not always so; it is not always so to-day; and those of us who have been in Albany and seen this octogenarian facing the snows of winter, at all hours of the day and night, and traveling about in the face of storms which appalled many others, will never forget his persistency, his good humor and his final success in the face of the greatest difficulties. Wherever and whenever he thought he could obtain a vote for an appropriation of this character, he never failed to try for it, and generally succeeded in getting it. And you must remember that many of the members of the Legislature are prejudiced against scientific research of all kinds, and we have had Governors who publicly announced their opposition to the use of public money for this purpose; so that often, after a long and weary winter in the passage of a bill giving the necessary funds for this purpose, it became necessary to see the Governor and obtain from him the approval of what already had caused so much work to obtain.

In closing these remarks, Mr. Chairman, I take great pleasure in joining with you all in wishing to Dr. Hall a long continuance of his life of activity. I understand that he has taken a long journey from the Pacific coast for the very purpose of being here with us on this important occasion, which certainly marks an epoch in his life and in the history of the Society. Not content, however, with stopping here for a brief visit, and then continuing in well-earned repose, I understand that in a few days he takes the field again, as a geolo-

gist, and may be found next week, perhaps, examining some of the portions of the State and adjoining States which have not yet been fully investigated. This is so characteristic of his energy and activity that it seems fitting to allude to it.

Prof. Fairchild, Secretary of the Geological Society of America, then presented the following communication from Dr. George M. Dawson, Director of the Geological Survey of Canada:

It would be inappropriate to permit the occasion of the meeting in commemoration of the sixtieth anniversary of Prof. Hall's work on the New York Survey to pass, without placing on record, on the part of the Geological Survey of Canada, an expression of indebtedness to the distinguished geologist of Albany. Upon his already well founded classification of the fossiliferous rocks of the State of New York the investigation of the connected region to the north has from the first been based, practically without change of plan or nomenclature.

Reviewing the geological nomenclature adopted by the Canadian Survey, for the general report of 1863, the Director, Sir William Logan, wrote:

"But, in addition to such general guidance, the Canadian Geological Survey has throughout been under special obligation to Prof. Hall. Soon after Sir William Logan began this Survey, in 1843, he established intimate relations with Prof. Hall and his colleagues of the New York Survey. In 1854 Prof. Hall took the trouble to appear personally before a select committee of the Legislative Assembly appointed to report on the work already done by the Canadian Survey. In the same year he undertook the examination of the Graptolites of the Quebec group, the results of which were eventually published as the Second Decade of our Paleontological Series. In 1855 he assisted in the field in tracing out the Devonian rocks of the peninsula of Ontario and, for the purposes of the geological map of Canada of 1866, he freely placed all his materials and knowledge of the northern part of the United States at Logan's disposal, becoming thus responsible for the delineation of nearly one-half of the completed map."

There is thus a particular fitness, at the present time, in adding a tribute of acknowledgment from Canadian geologists to the numerous felicitations which Prof. Hall will undoubtedly receive on the occasion of this commemoration.

Prof. John J. Stevenson, of the New York University, called attention to certain unwritten chapters in the history of the New York Survey, and expressed appreciation of Prof. Hall's remarkable fidelity to the interests of his Commonwealth, in the ensuing language:

Some matters, which exhibit most clearly Prof. Hall's unselfish devotion to his work, have not been referred to by the preceding speakers. They should not be overlooked. If I speak of them without reserve, it is to be hoped that Prof. Hall will not think me guilty of breach of confidence, for, unless the story be told now, most of us will die without hearing it. He has discovered the fountain of perpetual youth, and his obituary is not likely to be written until after the majority of us have been buried.

The care of collections made by the Survey was transferred to the Regents of the University in 1845, and Profs. Hall and Emmons were compelled to give up their rooms in the old State hall. Prof. Hall at once erected a building next to his residence to provide accommodations for his work; this proving too small, he erected a large brick building in 1856 for the same purpose; but no allowance for office rent or other incidental expenses was made by the

State until 1871.* The cost of collecting new material for elaboration of the reports was borne by himself absolutely until 1856, after which appropriations were made until 1866, from which date for many years very little assistance was granted.

The State abandoned the work in 1850, when appropriations for salary and current expenses were refused by the Legislature. Confident that the work would be resumed, Prof. Hall retained his assistants and continued the collecting and drawing until 1855, paying practically the whole cost. Despairing then of any assistance from the State, he accepted the proposition, made years before by Sir William E. Logan, that he go to Canada as paleontologist, with the expectation of becoming head of the Survey upon Sir William's retirement in the near future. But, during those five years, Prof. Hall had exhausted his cash resources and had incurred obligations which were pressing. A large amount of money was needed to pay his debts and to take him to Canada.

In 1838, with Mather and some gentlemen of Albany, New York and Philadelphia, he had purchased a large tract of land in southeastern Ohio; in the division there fell to him, as his share, 2,000 acres within Jackson and Lawrence counties, rich in iron ore and coal. This he laid aside, not to be sold until advancing years rendered him unable to work. In 1855 the importance of the mineral resources in southeastern Ohio was beginning to be appreciated, and all recognized that, within a very few years, property in that region would be extremely valuable. But Hall had nothing else that could be turned into money and his debts were urgent. He accepted an offer of $15,000 for the property; with that money he paid off the obligations incurred in order to continue his work. Ten years later the same land was valued at $200,000 and the accuracy of Hall's foresight was proved. Had it not been for this sacrifice the Paleontology of the State of New York would have been closed with the second volume in 1850.

In 1855 Hon. Elias Leavenworth, then recently elected Secretary of State, learned that Prof. Hall had determined to go to Canada. Realizing that to abandon the work in its incomplete condition would be discreditable to the State, he urged Prof. Hall to delay and called a meeting at his house to consider the matter. That meeting was attended by, among others, Prof. J. D. Dana, Prof. Agassiz, Sir William E. Logan, and Mr. Blatchford, Chairman of the Assembly Committee of Ways and Means. As the result a form of agreement was prepared, and Prof. Hall consented to remain in case the Legislature should confirm the arrangement. The influence of Mr. Leavenworth and Mr. Blatchford prevailed; the agreement was confirmed, and for forty years Prof. Hall has continued the work, until now it has been completed according to the original plan. Mr. Guilford Smith has told you with what energy he has carried it on, and how he has succeeded in overcoming what to others would have been insurmountable obstacles.

You have been told of the Wisconsin work, but not of the primitive manner in which the final settlement of arrears was made. At the close of the work the State owed Prof. Hall $4,000; thirty per cent. of this was paid in money; the remainder was paid in fossils which Prof. Hall had collected, largely at his own cost, as he had consented to the transfer of much of his appropriation towards a survey of the Lead Regions.

We should not forget that Prof. Hall

*Prof. Hall informs me that this statement is inexact, and that, while Hon. Homer A. Nelson was Secretary of State, an appropriation was made to cover pay of assistants and other expenses; but he cannot remember the details.

fitted out at his own expense the Meek and Hayden expedition to the Black Hills, which gave us our first accurate knowledge of the Rocky Mountain Cretaceous. In studying the collections obtained during this exploration F. B. Meek prepared himself for his own great work on the Jura and Cretaceous.

Prof. LeConte has told us that Prof. Hall led him into geology. When Prof. Hall made his memorable journey to the Mississippi Valley, in 1841, he remained for a short time at Cuyahoga Falls, in Mr. Newberry's house. Prof. Newberry was then a youth intelligently interested in collecting coal plants, which abounded in the roof shales of his father's mine, but he had no more intention of becoming a geologist than Prof. LeConte had when with Agassiz he visited Hall. Newberry used to say that Hall came as an angel, but before he went away he had become almost divine; the youth, before the separation, had made the final determination to be a geologist.

The paleontological laboratory at Albany has been the training school of great men, and through them the impress of the master remains upon American paleontology. In the fifties the assistant was Meek, whose painstaking and conscientious work in later years enriched the literature of Carboniferous and Cretaceous as that of no other American; C. A. White laid the foundation of his honored career when associated with Hall; Whitefield, whose contributions to Cretaceous and Miocene are already classic, was Hall's assistant for eighteen years; of the younger men, who have made American science respected, one need mention only Walcott, Beecher and Clarke to prove that the type of work and the standard of excellence have shown no deterioration since the time of Meek, more than forty years ago.

Several members of the Association and Geological Society made brief addresses, eulogizing Prof. Hall's work and recounting incidents in his history and the work of the Survey; the address of Dr. H. C. Hovey concerning Hall's remarkable energy and perseverance when, as a youth in eastern Massachusetts, he acquired his geologic education under difficulties and hardships which would have broken any but the strongest resolution, was particularly appropriate and significant.

Prof. Hall again responded briefly but appreciatively, touching on the remarkable development of geologic science in America since the institution of the official Survey in New York, and expressing the hope that the enrichment of the nation through the encouragement and constant application of research might long continue.

Vice-president Emerson then closed the session with the following remarks:

In bringing these interesting services to a close I permit myself to go far afield, beyond the dry light of science into the softer light of sentiment, and to draw a parallel in the manner of Plutarch. A veteran geologist, a past master in the art and science of geology, Josiah D. Whitney, has just died in New England—a man who was held by many to be of cold and repellant nature. I found him through many years a kind and appreciative friend. He was an enthusiastic and most critical lover of music. It was his custom to secure yearly two seats for his wife and himself in the front of the balcony in the Music Hall for the grand symphony concerts in Boston. His wife died many years ago, yet every year since then he secured the same seats where he listened to the music, and the seat beside him was always to him filled with her presence.

Amid the conflicting interests of a great and long-continued public service like that of Prof. Hall differences were inevitable, and the sounds of conflict carry further

than the quiet words of helpfulness and friendship. There was put in my hands recently by the wife of our former member, still greatly mourned and missed, Prof. George H. Williams, a massive medal of pure gold and beautiful workmanship, newly struck by James Hall, of Albany, to conserve the memory of the long-continued friendship and public support of a distinguished and influential publicist and patron of science, Daniel Wood, of Syracuse, who died many years ago. I do not need to say that Mrs. Williams, who is in deep sentiment still a member of the guild of geologists, values this unique monument to her father's memory. Four such medals were struck to the memory of four public men of this great State, each of whom was in turn two and three generations ago the Mæcenas of this struggling scholar and the patron of his public work. We may call these medals the monuments of the old-fashioned and enduring gratitude of a warm heart; they explain the strong friendship of his friends, and are more significant than the transient dust of conflict. The monument of the man himself is builded in the rocks of New York, a monument more enduring than bronze or gold.

And now I declare closed the proceedings of this afternoon, which, spread upon the archives of this ancient and enduring Society, will furnish a many-sided and appreciative estimate of a great scientific personage.

CURRENT NOTES ON ANTHROPOLOGY.

MALTHUSIANISM IN ANTHROPOLOGY.

OUR French colleagues are nothing unless practical. They cannot see the use of laboriously developing theories of sociology, and fighting them over in learned societies, unless the product is utilized for the public.

This tendency gave rise, at a recent meeting of the Paris Anthropological Society, to a scene that, allowing for difference in longitude, was not very unlike that which 'Truthful James' describes in the scientific society 'on the Stanislaw.'

M. Paul Robin, a declared 'neo-Malthusian,' commented sharply on a paper of M. Guyot on the diminishing population of France, the burden of which was, 'Faites des enfants.' M. Robin urged that improvident generation is destructive to individual and social development, unworthy of scientific endorsement and ruinous to true happiness. M. Dumont, another member, used some hard words, such as 'a homiside' and 'a degenerate,' with obvious application to M. Robin, who in turn took up the cudgels with alacrity and requested these terms to be noted. 'Degenerates,' he claimed, were brought about by parental indifference to the size of the families engendered by the passions. Self-restraint, here as elsewhere, is noble; and the limitation of families by artifical means, if the end in view is desirable, should be considered legitimate.

It is interesting to observe that anthropologic students recognize that their science is one eminently practical and 'actual.'

CRANIA FROM FLORIDA.

DR. HARRISON ALLEN'S 'Crania from the Mounds of the St. John's River, Florida,' just published in the Journal of the Academy of Natural Sciences, Philadelphia (4to, pp. 85, Plates XXII.), is the most thorough piece of work on American Craniology which has appeared since Dr. Matthews' studies on the Rio Salado remains.

It is broader than its title, for it not only describes the skulls collected by Mr. Clarence B. Moore from prehistoric Indian graves in Florida, but it enters into minute comparisons of these with others from remote parts of North America, and outlines the science of craniology as taught by the author, and explains the terms which he has selected to express its new departures.

The plates are accurately drawn and beautifully lithographed, aiding greatly the demonstrations of the text.

The classification adopted by Dr. Allen is that of the late Dr. James Aitken Meigs, to which he called attention some time since in the pages of Science. It has been overlooked even by such writers as Topinard and Sergi, although it anticipated both of them in important points.

The functions which determine the form of the skull are considered by Dr. Allen to be mainly three, the growth of the brain, the interstitial changes in the bones, and the action of the muscles attached to the skull. The last mentioned he justly considers deserves more attention than it has received.

The Memoir is rich in such suggestions and should be consulted by all students of the subject.

D. G. Brinton.
University of Pennsylvania.

CURRENT NOTES ON METEOROLOGY.

THE HIGHEST KITE ASCENT.

Although Science of October 16th contained a brief note on the recent high kite ascent from Blue Hill Observatory, some further facts as to this record-breaking feat will not be out of place here. Reference has already been made in these notes on previous occasions to the kite work now being done at Blue Hill, and attention has been called to the scientific value of this exploration of the free air. On October 8th all previous kite records were broken by an ascent which carried the meteorograph to a height of 9,375 feet above sea level, the greatest altitude previously attained having been 7,333 feet (see Science, Oct. 2, 1896, 489). The ascent began at 9.52 a. m. and ended at 9.05 p. m. Seven Eddy and two Hargrave kites were used, and more than three miles of wire were paid out. The meteorograph entered and passed through the clouds, as is shown by a record of very dry air above the clouds. The temperature fell from 46° on the Hill to 20° at an altitude of 9,375 feet above sea level. The pull on the wire was from 20 to 50 pounds at the start and ranged from 50 to 95 pounds at the highest point. The instrumental record was one of the best yet obtained.

The more the probable future of kite meteorology is considered, the more important does this means of exploring the upper air seem to become. The expense is very trifling as compared with the establishment of mountain observatories, or of balloon ascents, and as mechanical appliances are perfected for winding in the wire, and saving labor in other ways, the work of flying the kites will continually grow less arduous, and the heights attained will become greater. If the upper kites are sent up high enough to be out of reach of the varying and irregular currents near the earth's surface, there seems to be no reason for lowering the instrument at night, and if kept up 24 hours at a time, the results would be still more valuable than those now attained. Indeed it may be that continuous records may in time thus be obtained from the upper air by means of kite meteorographs.

WATERSPOUT PHOTOGRAPHS.

What is probably the best photograph of a waterspout ever taken was secured by Mr. J. N. Chamberlain, of Cottage City, Mass., on August 19th, last. On that day, at about 12:45 p. m., a very perfect waterspout, lasting 12 minutes, formed offshore from Cottage City. The photograph is remarkably clear, and brings out in a striking manner the dark clouds overhead, between which and the surface of the ocean is seen the spout, very symmetrically developed and almost exactly perpendicular. The top of the spout is but slightly enlarged, so that the funnel-shaped is not so marked as it is often figured, while at the bottom the disturbance of the surface water of the

ocean results in enlargement of the lower end of the funnel by the formation of an irregularly shaped cloud of vapor or spray. After the disappearance of this waterspout two others, both less perfectly developed, appeared in succession. These were also photographed, but the views are not so striking as in the first case. No authentic scientific account of these waterspouts has, so far as we have seen, been published. The 8 a. m. weather map of August 19th, shows an area of high pressure central north of the Lakes, with cool north and northwest winds over New England. It seems likely, therefore, that these waterspouts were due in part to the low temperatures brought by the winds. Most of the waterspouts which occur over the Gulf Stream in winter are produced under similar conditions of cool offshore northwest winds, although, of course, the temperature contrasts are much more marked in winter than in summer.

SEVEN-DAY THUNDERSTORM PERIODICITY.

KASSNER, of Berlin, has been investigating the matter of thunderstorm periodicity in Germany during the past few years and has reached some interesting results. In 1893 (*Das Wetter*, 1893, 12–16) he found that for the period 1883–92 the thunderstorms of Berlin showed a maximum frequency on Thursdays and a minimum on Mondays. Further study of the records for Berlin from 1830–40 and 1848–92 indicated a Saturday maximum and a Sunday minimum. Polis found that the thunderstorms of Aix-la-Chappelle also had a Saturday maximum and a Sunday minimum. This fact was naturally supposed to be connected in some way with the increased smoke resulting from extensive firing up in factories and foundries on Saturday, when much work often still remains to be done and has to be hurried through, or, as in the case of iron foundries, the metal is melted on that day in order that it may cool over Sunday. On Sunday, on the other hand, there is little smoke because little use is then made of fires. In *Das Wetter* for August and September, 1896, Kassner has continued his inquiry, using data for other places, and reaches the conclusion that in general the frequency of thunderstorms increases everywhere from Monday to Tuesday, and that a minimum occurs on Thursday or the next adjoining days. In cities with extended industries which require fires on a large scale there is everywhere an increase from Friday to Saturday, and a decrease from Saturday to Sunday, while in places without many factories the reverse is usually the case. The variations in atmospheric electricity are believed to stand in close relation to the variations in the amount of smoke, as previously suggested by Arrhenius and Ekholm (1894).

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NOTES ON INORGANIC CHEMISTRY.

THE manufacture of acetylene, at a low price, from calcium carbid, and its remarkable power as an illuminant, promised rapid development of its production upon a commercial scale. Two schemes are in use for its distribution. In one the plant is local, acetylene being made on the premises where it is used. In the other the acetylene is made on a larger scale and delivered in steel cylinders, condensed under high pressure.

The fact that acetylene is an endothermic compound has given rise to fear that grave danger attends its use, especially when stored in cylinders under high pressure. Hence recent experiments of Berthelot and Vieille (Comptes Rendus, CXXIII.: 523) on the explosive properties of acetylene possess considerable interest. They find that, at atmospheric pressure, a decomposition induced by ignition, or by the ex-

plosion of a fulminate, does not propagate itself to an appreciable distance. Hence it would seem that local acetylene generators, where the gas is not exposed to a pressure much above that of the atmosphere, are free from danger of explosion. When, however, the pressure on the gas is greater than two atmospheres, the decomposition induced by an incandescent wire, or otherwise, is propagated through the whole mass, the rapidity of propagation and the pressure of explosion increasing rapidly with increased initial pressure. Thus acetylene, at a pressure of twenty-one atmospheres, when exploded, generated a pressure of two hundred and twelve atmospheres and a calculated temperature of 2750° C. The acetylene is decomposed quantitatively into hydrogen and compact amorphous carbon. Acetylene condensed to a liquid may be similarly exploded by spark, incandescent wire, or detonator, and in one experiment 18 grams of acetylene exploded in a bomb of 49 c.cm. capacity showed a pressure over 5000 atmospheres, an explosive force about that of gun cotton. Experiments as to the effect of shock showed that acetylene is not thus exploded. In one case where the receptacle was broken by the shock, the acetylene was ignited, evidently by the friction of the shattered pieces, the mixture of the liberated acetylene and air forming an easily ignited explosive mixture. In this case no carbon was deposited, the gas burning and not decomposing. There seem to be two prominent dangers in compressed acetylene: the heat generated in the rapid compression of the gas may be sufficient to explode it; in case of fracture of the receptacle the explosive mixture of acetylene and air may be ignited by friction.

The authors conclude that the advantages in the use of the gas more than compensate for the dangers attending its use, which, with sufficient care, may be reduced to a minimum.

Another question has been raised regarding the use of acetylene which is not touched upon in this article. Acetylene forms, with certain metals, very explosive compounds. Whether in its use as an illuminant there is danger of such compounds being formed, is a point which deserves investigation.

In the last *Chemical News*, Dr. Geo. F. Payne, of the Georgia Department of Agriculture, offers a just criticism of a statement in the last edition of Blyth's 'Poisons.' Dr. Blyth states that cotton seed is poisonous to animals, and its use as an adulterant of linseed cake has caused the death of sheep and calves. Dr. Payne calls attention to the extended and successful use of whole cotton seed, cotton-seed meal and cotton-seed hulls in the South for fattening cattle, and suggests that the cases cited by Dr. Blyth may be due to castor-oil pomace, either accidentally mixed with the cotton-seed meal, or in a mixture intended for fertilizing purposes and inadvertently used for feeding animals.

In the recently published second edition of 'The Cyanide Process of Gold Extraction,' by James Park (Auckland, N. Z., Champtaloup and Cooper), it is stated on the authority of Johann Antal, a Hungarian toxicologist, that a solution of cobalt nitrate is a perfect antidote to cyanid poisoning. A matter of so much importance if true, deserves very careful investigation and confirmation. J. L. H.

ASTRONOMICAL NOTES.

The *Astronomical Journal* of October 16th contains a determination by Mr. Eric Doolittle of the secular perturbations of Mercury arising from the action of Jupiter. Gauss's method was employed.

In the *Astronomische Nachrichten* of October 8th Dr. Marcuse, of Berlin, publishes an account of the new photographic zenith telescope recently constructed for the Geo-

detic Commission, and gives an extended trial series of observations which he has made with it. The instrument is used like an ordinary zenith telescope, except that the stars are allowed to trail across a photographic plate in the focal plane, instead of being bisected with the usual filar micrometer. The distance between the trails can then be measured under a microscope. For the determination of the scale-value Dr. Marcuse uses Pleiades trails, and for the Pleiades stars adopts places based on the Yale triangulations of Elkin and the photographic observations made at New York by Rutherfurd. Dr. Marcuse finds as the result of the whole research that the photographic method is capable of about the same precision as the visual method. The output of work seems to be about the same for the two methods also; and in this respect the zenith telescope would seem to be an exception. For in most other applications of photographic astrometry the great advantage of the photographic method has been found to be the immense saving of labor permitted by it.

WE have received the first volume of the Annals of the Strassburg University Observatory. It is a large quarto containing xcviii. and 340 pages. After a description of the new observatory, there follows an elaborate investigation of the Repsold meridian circle and the observations made with it between 1882, March 15, and 1886, September 9. The volume closes with a series of plates illustrating the construction of the meridian observatory. The next volume is stated to be in course of publication, and will contain a definitive catalogue of stars derived from the Strassburg meridian observations.

THE Observatory of the University of Virginia has issued Part 7 of its publications, containing observations of the nebula in Orion, by Ormond Stone.

THE second part of the proceedings of the 1895 meeting of the International Geodetic Commission has been issued. It contains the usual reports upon the present condition of geodetic work in Europe.

H. J.

SCIENTIFIC NOTES AND NEWS.

M. AUG. LUCIEN TRÉCUL, botanist, member of the Paris Academy, died at Paris on October 15th, aged 78 years.

WE regret to notice, among other recent deaths of men of science abroad, those of Dr. R. E. Kerry, director of the bacteriological laboratory of the Vienna Veterinary Institute, at the age of 34; of Dr. Eugen Sell, associate professor of chemistry in the University of Berlin and director of the chemical laboratory of the Imperial Health Office, on October 13th, at the age of 54; of Dr. Julius Theodor Wolff, astronomer at Bonn, on October 11th, at the age of 70 years; of Dr. E. Czerkawski, formerly professor of philosophy at Lemberg, on September 21st, at the age of 74, and of Dr. Saul Kowner, formerly medical director of the Njeschin District Hospital (Russia), author of a work on the philosophy of Spinoza and of a history of medicine, in three volumes, aged 58.

WE regret to record the death of Dr. H. Newell Martin, which occurred at Burley, England, on October 29th Martin was born, in 1848, in Newry, Ireland. He studied at University College, London, and received the degrees of B. S. in 1870, of M. B. in 1871, and of D. Sc. in 1872. From the University of London he went to Christ College, Cambridge, where he took the degree of B. A. in 1874, and that of M. A. in 1877. He became a fellow of his college, and lecturer on natural history. On the organization of the Johns Hopkins University, in 1876, Martin, on the recommendation of Huxley, was made professor of biology, and retained this office till 1893, when his health became impaired. Martin belonged to the faculty of the Johns Hopkins University when its six or seven members gave the University its great reputation and trained a large part of the American students now engaged in university teaching. Martin did his

full share in the accomplishment of this work. His lectures were admirably clear, and by teaching and example he greatly stimulated his students in original research. His own work on the physiology of the heart and in other directions is well known. His friends and former students published recently a collection of his scientific papers and addresses, which we hope to review shortly in this JOURNAL. Only a month ago we called attention to the revised edition of 'The Human Body,' and stated that "the book remains the best compendium we have covering the anatomy, physiology, psychology and hygiene of the human body." Martin's untimely death is in every way a cause for deep regret.

THE Association of American Agricultural Colleges met in Washington, D. C., on November 10th, 11th and 12th.

THE annual convention of the American Society of Mechanical Engineers will be held at the house of the Society, 12 West Thirty-first street, New York City, from December 1st to 4th.

THE Bradshaw Lecture, by Dr. W. R. Gowers, on 'Subjective Sensations of Sound,' was delivered before the Royal College of Physicians of London on Thursday, November 5th.

THE comet medal of the Astronomical Society of the Pacific, founded by Joseph A. Donahoe, has been awarded to M. Giacobini, of the Observatory at Nice, France, for his discovery of an unexpected comet on September 4, 1896.

MR. J. WOLFE BARRY gave his presidential address to the London Institution of Civil Engineers on November 3d.

DR. LUDWIG REH, of São Paolo, Brazil, has been appointed permanent assistant to the Concilium Bibliographicum, Zurich.

THE Academy of Sciences at Budapest has received a bequest of 10,000 fl. from the late D. P. Von Palast.

IT is proposed to raise the subscription to the Physical Society, of London, and that hereafter members shall be known as 'fellows.'

THE lecture of M. Moissan before several of the scientific societies of New York, on October 27th, was followed with great interest by a large and representative audience. Even those unable to understand French appreciated the experiments with the electric furnace, showing the artificial production of diamonds and the volatilization of silica.

DR. FELIX KLEIN has been the guest of the faculty of the University of Pennsylvania. The graduates from Göttingen who reside in Philadelphia gave him a dinner, and he was also entertained by the Mathematical Club.

Popular Astronomy states that Prof. Winslow Upton, of Ladd Observatory, Brown University, is now at Harvard College Observatory, at Arequipa, Peru, engaged in making latitude and longitude observations. Mr. DeLisle Stewart, a graduate of Carleton College, is now one of the regular observers in the Observatory. He is engaged largely in photographic work, the photographs being sent to Harvard Observatory.

DR. L. SERRURIER, director of the Ethnographic Museum in Leiden, has resigned because the state will not rebuild the museum building.

THE Flower Astronomical Observatory of the University of Pennsylvania has been completed and will be used at once by graduate students. It is well equipped with instruments, the lenses of which were made by Brashear and the instrumental parts by Warner & Swasey. The Flower Observatory is outside the city, but a working observatory, for the benefit of the undergraduates taking the college course in astronomy, has been erected near the other university buildings. This building will be equipped with a transit instrument, zenith telescope and a four-inch equatorial—the gift of Horace Howard Furness, Jr.

A DESPATCH from Madrid says that the town of Huelva, in the province of that name, has been swept by a tidal wave from the Atlantic Ocean. No details are given, but the report says it is known that the loss of life has been great. The steamer Carthegena was overwhelmed by the great wave and most of the persons on board were drowned. Huelva is a town on an inlet of the Atlantic, forty-nine miles west, northwest of Seville. The population of the town is about twelve thousand.

A MUSEUM of natural history, geology, archæology and technology is proposed (says *Natural Science*) for Hertfordshire, and a site near St. Albans has been offered by Lord Spencer, upon certain conditions. A sum of at least £5,000 must be raised for building and endowment, and the museum is to be in the hands of the County Council. We are glad to see that a curator is thought of as much importance as a building. A provisional committee has been appointed, including Lord Cowper, Sir John Evans and the Hon. Walter Rothschild.

ACCORDING to *Die Natur*, a Congress for astronomers of all nations, met at Bamberg on September 17th. There were present thirty foreign members, including Father Hagen, of the Georgetown Observatory, who described his Atlas of Variable Stars, which is now in press; papers were also read by Prof. Bauschinger, the new director of the Astronomical Bureau of Calculations at Berlin; Prof. Schur, director of the Göttingen Observatory, and others. The next Congress will meet at Budapest, 1898.

A NOTE in the N. Y. *Evening Post* (quoting from an account in the London *Times*, of a report of Mr. Gosselin, of the British Embassy in Berlin) states that the authorities in German East Africa have put into force a series of regulations intended to check the indiscriminate slaughter of elephants and other big game. These rules, promulgated at Dar-es-Salaam, provide that every hunter must take out an annual license, for which the fee varies from five to 500 rupees. The shooting is prohibited of all young game—calves, foals, young elephants, either tuskless or having tusks under three kilos, and of all female game, if recognizable. Further, in the Moschi district of Kilima-Njaro, no one, whether possessing a license or not, is allowed without the special permission of the Governor to shoot antelopes, giraffes, buffaloes, ostriches or cranes. Those who are not natives have to pay 100 rupees for the first elephant killed and 250 for each additional one, and 50 rupees for the first rhinoceros and 150 for each succeeding one. Special game preserves are also to be established. Major von Wissmann suggests that the station authorities should endeavor to domesticate zebras (especially when crossed with muscat and other asses and horses), ostriches, and hyena dogs crossed with European breeds. It is thought that the best means of preventing the extermination of elephants would be to fix by international agreement among all the powers on the East African coast a close time for the animals, and to forbid the exportation or sale of tusks under a certain size.

UNIVERSITY AND EDUCATIONAL NEWS.

BY a decision of the University of the State of New York the degrees B. A. or A. B. and Ph. D. shall not, in the State, be conferred *causa honoris* after January 1, 1897.

THERE are 107 students in Wellesley College taking a course in geology which extends through the entire year. The course is given by Prof. Wm. H. Niles and Miss Elizabeth F. Fisher.

IT is proposed to build next year a laboratory of hygiene for the veterinary school at Berlin. Dr. Ostertag has been appointed to the chair of hygiene.

WOMEN have not been able to study medicine in Russia since 1882. Widely signed petitions, asking for the admission of women to the universities, have not been granted, but the Czar has sanctioned a decree creating a medical school for women in St. Petersburg.

SOME months ago the Bellahouston Trustees promised to the Glasgow University a donation of £12,500 towards the foundation of an engineering laboratory, provided that a similar sum was obtained by private subscriptions or otherwise. To fulfil this condition a committee was formed, and the Glasgow correspondent of *The Lancet* learns that nearly the whole of the sum required has been raised, so that the erection of the new laboratory will be commenced in the coming spring.

PROF. SCHENK has been promoted to a full professorship of anatomy in the University at Vienna, and Dr. London, of the University of Breslau, to an associate professorship of mathematics. Dr. Kippenberger, Privatdocent at Jena, has been called to the professorship of chemistry in the medical school at Kairo.

DISCUSSION AND CORRESPONDENCE.

THE LENGTH OF A CURVED LINE.

I SHOULD be very sorry to have anyone interpret my remarks in a recent number of SCIENCE (see page 533) as imputing ignorance of fundamental principles to so distinguished a geometer as Prof. Halsted. In saying that Prof. Halsted 'appears to believe' that he has given a logically complete discussion, my meaning was that he so appears to the unassisted reader of his 'Elements of Geometry.' My criticism was directed at the book rather than at the man. Further, as he says in his reply on page 656 of SCIENCE, the criticism is not applicable to his more recent work, 'Elementary Synthetic Geometry.'

In my opinion, it is not possible to discuss, in an elementary manner, propositions relating to the magnitude of curved lines until after the introduction of the following postulate: *The magnitude of a curved line is the limit toward which a broken line made up of consecutive chords of that curved line approaches, when the number of chords is increased in such a manner that the chords are all diminished without limit.* After the introduction of this postulate it is possible to compare the magnitude of a curved line with that of a straight line.

To turn again to Prof. Halsted's 'Elements of Geometry,' not only was it an error of logic to attempt to demonstrate without this postulate, or its equivalent, that a straight line is the shortest line joining two fixed points; but it was an error of the same sort to introduce, on pages 162–165 of that work, propositions relating to isoperimetric figures, which from their very nature depend on a comparison of non-congruent lines.

It seems worth while to insist upon the points made in this note and in my preceding note, because they relate to subjects treated in almost every American text-book of geometry; but in none, so far at least as the writer is aware, has a thoroughly satisfactory treatment been given.

In the very recent text-book of Beman and Smith, of which the writer has expressed a high opinion (See SCIENCE, this volume, page 203), the following appears on page 187:

"POSTULATE OF LIMITS. The circle and its circumference are the respective limits which the inscribed and circumscribed regular polygons and their perimeters approach if the number of their sides increases indefinitely.

"This statement is so evident that a proof is not considered necessary. Like valid proofs of many fundamental principles, it is too difficult for an elementary text-book."

The statement consists of two parts, one relating to superficial magnitude, the other to linear magnitude. The former is capable of simple proof. The circle is greater than any inscribed polygon, and any circumscribed polygon is greater than the circle; by the axiom, *the whole is greater than any of its parts.* Proofs based upon these considerations are older than the text of Euclid. The second part of the statement is a 'postulate' in a strict sense. It cannot be proved at all except from equivalent assumptions.

THOMAS S. FISKE.

OCTOBER 31, 1896.

ON CRITICISMS OF ORGANIC SELECTION.

A LONG absence in Europe has prevented my seeing several criticisms of my papers in this JOURNAL, until very recently; and although the issues may now be forgotten by the critics as well as by the readers of SCIENCE, I venture to write a few lines, if only to express my thanks for the kindly words which have aided me to see where the articles were not clear.

First, I may say that I have published, in the *American Naturalist* (June and July, 1896), a paper of some length under the title 'A New Factor in Evolution,' gathering the positions of the SCIENCE articles into a single sketch, thus carrying out, to a degree, the suggestion made by Prof. Wesley Mills in SCIENCE, May 22 (a suggestion which, however, I did not see until my return in September). Condensed summaries of the two main positions involved in the doctrine of Organic Selection (which I ventured to call a 'new factor') were quoted in this JOURNAL for July 31, p. 139, and I need not stop to requote them.

I am glad to know, both from Prof. Mills' article in SCIENCE, May 22d, and also from a personal letter from him, that he accepts the class of facts which I have emphasized, and admits their importance (having himself before

pointed out the imperfection of instinct)*; the point of difference between us being in their interpretation with reference to the inheritance of acquired characters. I hope the charge of obscurity which he brought against my SCIENCE articles holds to a less degree of the fuller presentation of the case against Lamarckism in the papers in the *Naturalist*. I may express the wish—in the way of a friendly suggestion of a reciprocal kind to Prof. Mills—that he take up the arguments which I have advanced to show that the Lamarckian view of heredity is not entitled to the exclusive use of the principle of use and disuse, but that evolution may profit by the adaptations of individual creatures without the inheritance of acquired characters, through what I have called Organic Selection, and show why they do not apply.

As to the 'newness' of the general view which I have published, that is a matter of so little importance that I refer to it only to disavow having made untoward claims. Of course, to us all 'newness' is nothing compared with 'trueness.' As to the working of so-called Social Heredity, I am not aware that I called the position new, *i. e.*, that social influences do aid the individual in his development and enable him to keep alive. This had been taught by Wallace, and later was signalized—as a note on my papers points out in *Nature*—by Ritchie and by Weismann. What I thought was new about Social Heredity was the name, which seemed to me appropriate for reasons given in the *Naturalist* articles, and also the use made of it to illustrate the broader principle of Organic Selection—which latter principle I did and do still think to be new. A word in regard to it.

If we give up altogether the principle of modification by use and disuse, and the possibility of new adaptations in a creature's own lifetime, we must go back to the strictest Preformism. But to say that such new adaptations influence phylogenetic evolution only in case they are inherited, is to go over to the theory of Epigenesis. Now what I hold is that these individual adaptations are real (*vs.* Preformism), that they are not inherited (*vs.* Epigenesis), and yet that they influence evolution. These adaptations keep certain creatures alive, so put a premium on the variations which they represent, so 'determine' the direction of variation, and give the phylum time to perfect as congenital the same functions which were thus at first only private adaptations. Thus the same result may have come about in many cases as if the Lamarckian view of heredity were true. A case of special miportance of this is seen in *intelligent adaptations*, and one of the most interesting fields of intelligent adaptation as that of *social cooperation.** The general principle, therefore, *that new adaptations effected by the individual may set the direction of evolution without the inheritance of acquired characters* is what I considered new and called Organic Selection (also for reasons set out in the *Naturalist* articles).

Prof. Cattell, writing with thorough appreciation of the principle (in *The Psychological Review*, September, 1896, p. 572), cites Darwin's doctrine of Sexual Selection as a case from the literature. This case also occurred to me this summer. Apart altogether from the truth or falsity of Sexual Selection, the use which Darwin made of it was directly in the way of what it seemed well to me to call Organic Selection. Sexual Selection would be, if proved, a particular and special case of Organic Selection. But Darwin, as I think—subject to correction by those more familiar with the literature—found the importance of Sexual Selection in the fact that it took effect directly in the pairing of mates and so influenced posterity. I do not know that Darwin advanced the general truth that all personal adaptations which were of 'selective value'—*i. e.*, which were useful enough to enable a creature to escape with his life—would bring about indirectly the sort of effect upon pairing that Sexual Selection would. But whether he did or not, if that be true, then evidently the special case of Sexual Selection does not cover the whole influence, and there is the same reason for giving the whole influence or 'factor' a name that Darwin had for giv-

* The phrase 'half-congenital,' referred to by Profs. Mills and Bumpus, was used as expressive rather than as a suggestion in terminology!

* These are the two main cases dealt with in my SCIENCE articles, and to my mind (speaking for no one else) the main interest attaching to the imperfection of instinct, discussed lately by various writers in these pages, is that it shows this 'factor' at work.

ing a special name to the particular case of Sexual Selection.

In short, does not the formulation of any positive influence which regulates the operation of Natural Selection really indicate a 'factor' in the whole evolution movement? Darwin formulated Sexual Selection as such a factor. Wallace's 'recognition-mark' theory of the origin of bright plumage in male birds is another such formulation. Organic Selection formulates the general factor which both these positions—and possibly others—illustrate; 'newness' in any other sense I am not disposed to maintain for it.

Darwin's personal use of the principle of Sexual Selection, I may add, seemed to require a very high psychological development on the part of the choosing mate, the female; but the way that the principle may be generalized—although still with reference to the special case of mating—may be seen in the very interesting suggestions of Groos (*Die Spiele der Thiere*, pp. 230 ff).

More than one of my critics have spoken of the relation of Organic Selection to Natural Selection. It is discussed at some length in the *Naturalist* article (July, pp. 549 ff). Prof. Cattell says: "It is the essence of Natural Selection that under changed environment those individuals will survive who can best adapt themselves to it." Certainly it is. But I think that the advocates of Natural Selection have considered as useless or uninfluential in evolution those adaptations of individuals which were not adequately represented in the *congenital equipment* of the individual. Certainly the tendency, at least, of the Neo-Darwinians has been to deny the influence of the principle of use and disuse on evolution—to consider it altogether a part of the machinery of Lamarckism.* *The influence of new adaptations, however, in determining the limits of variation in subsequent generations without appealing to the inheritance of acquired characters;* that (to repeat) is the combination which I considered new, although I should not have had the courage to label it so if certain biologists familiar with the history of discussion had not so characterized it.

If Romanes, for example, had thought of this answer to Lamarckism, I cannot conceive that he would still have pressed his argument for the inheritance of acquired characters drawn from the coordinated muscular movements seen in instinct; and in this particular case—the origin of instinct—I think the doctrine of Organic Selection gives a new theory.

So far, however, from opposing Natural Selection appeal is made directly to it. The creature that can adapt itself gets its value only because it is selected, as Natural Selection does all its selecting. Even might we say that the very ability to make personal adaptations may possibly be due to Natural Selection. But I can not go with Prof. Cattell in saying: "If Organic Selection is itself a congenital variation, as Prof. Baldwin indicates [as possible,]* we are still in the *status quo* of chance variations and Natural Selection." Not entirely, I think, since the future variations are narrowed down in their range within certain limits. Say a creature is kept alive and begets young because he can adapt himself intelligently or socially, and say his mate has the same character; then the drift of variations in the next generation will be in the same direction, as Prof. Cattell himself recognizes.† Of course, as far as this point goes, we do 'remain ignorant as to why the individual makes suitable adaptations;' that is quite a different question, involving I think, for adaptations in the sphere of muscular movement, another application of Natural Selection, *i. e.*, to overproduced or excessive movements‡; but we do not remain ignorant as to 'why congenital variations occur in the line of evolution,' admitting that they occur at all. And, of course, we do remain in ignorance as to why 'they [variations] are hereditary;' that again is a matter of the mechanism of heredity.

In connection with this question of 'newness'

*Thus they would say: The intelligence is congenital, but the particular things learned by intelligence, not being inherited, have as such no influence on race development, except as the children also learn to do these things intelligently.

*Cf. my *Mental Development*, pp. 172 ff. 204 ff.

†In the illustration he gives of Organic Selection, *i. e.*, of dogs becoming granivorous from feeding on grain during many generations.

‡Criticisms of this hypothesis I can not consider now, but hope to answer them soon in *The Psychological Review*.

—as much as I dislike to dwell upon it—I must refer to another remark by Prof. Cattell. He says that I leave it in doubt whether I mean to say that this principle of Organic Selection was stated in my book on *Mental Development*, and also that he can not tell from his memory of the book. This is a fair question. The principle was suggested in the book, as the following quotations will suffice to show: "It is necessary to consider further how certain reactions of one single organism can be selected so as to adapt the organism better and give it a life history. Let us at the outset call this process 'organic selection,' in contrast with the natural selection of whole organisms." * * * "The facts show that individual organisms do acquire new adaptations in their lifetime, and that is our first problem. If, in solving it, we find a principle which may also serve as a principle of race development, then we may possibly use it against the 'all-sufficiency of natural selection,' or in its support" (Pp. 175–6). Then in speaking of the results of the individual's adaptations on the course of evolution: "This again is exactly the same result as if originally neutral organisms had learned each for itself. * * * The life principle has learned, but with the help of the stimulating environment and natural selection (173)." Again in speaking directly of heredity (p. 205 f): "It [Neo-Darwinism] denies that what an individual experiences in his lifetime, the gains he makes in his adaptations to his surroundings, can be transmitted to his sons. This theory, it is evident, can be held on the view of development sketched above, for granted the learning of new movements in the way which I have called 'organic selection' * * yet the ability to do it may be a congenital variation. * * * And all the later acquirements of individual organisms may likewise be considered only the evidence of additional variations from these earlier variations. So it is only necessary to hold to a view by which variations are cumulative [*i. e.*, the view of Organic Selection] to secure the same results by natural selection as would have been secured by the inheritance of acquired characters from father to son." (See also p. 206.) I may be allowed, also, in view of the charge of obscurity made by Mr. Cattell—and the appearance of which comes in part, at least, from the need of condensation—to cite the following sentences from a review of my book in the London *Speaker*. Giving an exposition of the position which the book takes on the subject of heredity, the reviewer says: "If, however, creatures having the ability to make intelligent adaptations which become consolidated into habits (called 'secondary instincts)' are selected for survival, it is just as if secondary instincts were acquired by actual transmission to offspring of the modifications produced in parents by the exercise of their own intelligence. Psychologists may, therefore, practically speak as if acquired mental characters were really inherited, though what is inherited may be only the ability to acquire them. Such ability, of course, natural selection would accumulate like any other variation." The passage which this reviewer refers to is in *Mental Development*, p. 207, a passage which was expanded, *apropos* of Romanes' doctrine of the origin of instinct, in my paper in SCIENCE, March 20, 1896.

While suggested in the book, however, it is not enlarged upon, since the section on heredity was written only to show that either of the current views might be held together with the main teaching of the book.

I regret taking so much space for these personal explanations, but the editor of this JOURNAL can spare the space, since it is he who asked the question!

Prof. Cattell also finds obscurity in my view of the place of consciousness in evolution. The obscurities are possibly cleared up somewhat in an article on 'Consciousness and Evolution' in the May, 1896, issue of *The Psychological Review*.

J. MARK BALDWIN.

PRINCETON UNIVERSITY,
October 27, 1896.

THE relations of individual adaptations to race evolution will shortly be reviewed in this JOURNAL by Prof. Lloyd Morgan and by Prof. Osborn. I think that the important principle called by prof. Baldwin 'Organic selection' is implicit in Darwin's works, and has been clearly formulated by Prof. Weismann.

J. MCKEEN CATTELL.

THE INSTINCTS OF BIRDS.

To the Editor of Science: So much interest is now taken in psychology that, although it is not the field of science with which I am most familiar, I believe that the statement of an observation I made this summer may be of interest.

My hired man brought home a nest of young hawks, probably a week old. We tried to rear them on meat. After a few days I noticed in some way that they tried to peck at a *red* rag. It occurred to me to try if the color had any influence. I found that, while they would sometimes peck at any rag, they would always attack a red one. It would seem, therefore, that they noticed the red of the meat.

We also found that they were cannibals, for, not being fed quite enough meat one day, they attacked the weakest one, and would have killed it; in fact, it did die in a day or two.

Geo. Chas. Buchanan.

Henning, Minn.

FINAL SUMMARY REPORT OF THE GEOLOGICAL SURVEY OF PENNSYLVANIA.

To the Editor of Science: In your issue of June 12, 1896, there appeared over the signature of Dr. J. J. Stevenson a brief review and criticism of the Final Summary Report of the Geological Survey of Pennsylvania, in which Dr. Stevenson was good enough to commend, in general, the results attained under such adverse circumstances as the general public could hardly be expected to realize.

It was several weeks after this article was written that my attention was called to it, and in writing to the author of it, to thank him for his very generous praise, I expressed chagrin and regret that he should have taken apparent exception to the *manner* and *place* in which credit was given to the various assistants whose work and reports formed so large a part of, and the basis for, Volume III., in the compilation of which I was so largely responsible.

In his reply, as well as in the original article, Dr. Stevenson was courteous enough to realize the absence of any intention to detract from the very high merit due him and others for the painstaking work they performed in elucidating the geology of the State, but very properly pointed out that the casual reader of the Final Summary, from the character and number of references to his name in connection with the chapters on the bituminous coal measures in southwest Pennsylvania, might readily fail to give credit to him for his labors in that district.

After carefully reviewing the chapters referred to, pp. 2448 to 2564 in Vol. III., Part 2, I cordially endorse Dr. Stevenson's criticism, and ask the medium of your widely read journal, not only to express my sincere regret for that deficiency in the Summary, but to accord to Dr. Stevenson the fullest possible credit for his exceptionally excellent work in the coal district.

To all who have had access to the reports of the Geological Survey this tribute is hardly necessary; for the several volumes* which bear his name attest the fidelity and general value of his work as well as the high scientific character of his investigations; but to such as have not become familiar with these individual volumes it gives me only pleasure to say, that not only were his several reports (in common with those of many other assistants) freely used by me in my compilation of the survey in the Bituminous Region, but his sections, plates and measurements of coal beds as well, and I regard them as amongst the most valuable and reliable data secured during the progress of the survey.

This was the object of the 'Summary Report,' and if space and means had permitted it, every assistant's name should have been attached to his particular work, in the body of the report as well as in my prefatory letter (see Volume III., Part I., pp. 1855 and 1856), where a general acknowledgment was made of the work of all the aids.

To Dr. Stevenson, as well as to the Messrs. Platt, White, Ashburner, Chance and Sherwood, is Pennsylvania indebted for a wealth of facts concerning the geology of the Appalachian coal field. To them all, and individually, are due my heartiest acknowledgments in the preparation of the 'Summary Report,' and above all, to the venerable Director of the Survey, Dr. J. P. Lesley, whose notes, illustrations and valuable prefatory notices, were all freely

* Reports K, K_2, K_3 and T_2.

accorded and made use of by me for the benefit of the object in view.

E. V. D'INVILLIERS.

PHILADELPHIA, PA.

SCIENTIFIC LITERATURE.

General Principles of Zoology. By RICHARD HERTWIG. Translated by GEORGE W. FIELD. Henry Holt & Company, New York. 1896.

The most pressing need for teaching elementary zoology in American schools is a suitable text-book; one that treats the general principles in a way that clothes with flesh the skeleton of systematic zoology; one written with genius that holds the attention and inspires. It must be clear and compact. Prof. Hertwig's 'Lehrbuch der Zoologie' is such a book, and an English edition will doubtless give an impulse towards better teaching and better discipline in acquiring the foundations of animal biology. The separation of the 'General Principles' from the 'Systematic Part' as an independent volume may be regarded as an advantage, since its clear, comprehensive, though brief, generalizations and discussions make it a useful handbook for teachers, students and general readers who want to find and understand the latest position of the science.

In the introduction the author defines the purpose of zoological study, morphology, comparative anatomy, ontogeny, etc. The body of the book proceeds under two general heads—'The History of Zoology' and 'General Morphology and Physiology.' The former covers sixty-seven pages in which are presented with surprising satisfaction and impartiality the positions of the creators of the science from the systematists and anatomists of classic antiquity to the investigators and teachers of to-day. Two-thirds of this space is justly given to the theory of descent, its history and proofs. Lamarckianism and Darwinism are succinctly interpreted and the additions and modifications suggested by advocates and opponents stated. In the general morphological part after certain definitions are given comes the history of the cell and the general principles of cytology; the latter and the chapter on general embryology are perhaps the most helpful in the book and leave little to be desired in a summary of these subjects. If one wants to know the position of zoologists on mimicry, distribution, promorphology, or the nature of species, this modest manual will afford him a reliable exposition.

The translator certainly deserves much credit for his part, scarcely an involved or muddy sentence occurs. The illustrations are familiar but well selected.

One so disposed might make a case in apparent criticism, for example, the young sponge figured on page 159, named '*Spongilla fluviatilis* (after Huxley),' some would prefer to see as *Meyenia fluviatilis* (after Lieberkühn); again on page 199: "Many *Protozoa* fuse with one another and form large bodies in which the individual animals can still be recognized." This seems to imply more than some feel like granting. *Ophrydium versatile* and *Proterospongia haeckeli*, for example, occur in large masses with hundreds of individuals imbedded in the support of cast-off or accumulated matter for protection; it seems to mean no more than the compound pedicels of other forms, or a chain of the loricæ of *Cothurnia variabilis*. But such differences may not be criticisms and certainly do not detract from the usefulness of the book.

Surely all who read this treatise will earnestly hope that the systematic part of the 'Lehrbuch' may speedily follow in the same admirable style.

D. S. KELLICOTT.

OHIO STATE UNIVERSITY.

Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbelthiere. DR. MED. ALBERT OPPEL. Erster Theil; Der Magen. Jena, Gustav Fischer. 1896.

Since Leydig's 'Histologie' appeared forty years ago there has been no systematic attempt at a summary of our histological knowledge. The works on histology have confined themselves chiefly to the histology of man and the higher animals, except in cases where a lower form happened to be especially favorable for purposes of illustration. The study of histology has been so closely connected with that of medicine that this is not to be wondered at; but now, when the value of comparative study is so obvious, and when the lower animals are being studied from a purely scientific point of view, an attempt to collate and arrange the

scattered facts of histology must be welcomed as affording a comprehensive review of past work and a firmer basis for investigation. The author of this Comparative Microscopical Anatomy has made this attempt for the Vertebrata and has succeeded admirably, if one may judge from the character of Part I., which is all that has appeared.

The work is conceived with the characteristically German disregard of difficulties and long years of labor, although the author recognizes the magnitude of the task before him. Indeed, in his preface he states that his notes are so arranged that his successor will be perfectly able to continue the work, if it should drop from his hands.

Part I. treats of the histology of the stomach. Just why Dr. Oppel should have begun with this organ is not clear. It would seem that the study of the organs in some natural series would preserve a more logical order. Why not begin with the upper end of the alimentary canal, for instance, and follow with the different sections in their order?

A work of this nature must, of necessity, be largely a compilation of facts or opinions gathered from the literature on the subject. Furthermore, it is important that the authorities be given, in order to avoid confusion and to enable the student to refer to the original papers. This end the author has had in view throughout the work. As he himself states, the book is intended not to replace the literature, but to serve as a key to it. In his references not only the name of the author is given, but also the year of publication, and an empirical number referring to the alphabetical index of authors, where the title and place of publication are given in full. The summary of each author's view, whether it be a few words only or several paragraphs, is enclosed between two straight bars placed obliquely (//). This arrangement aids distinctly in separating sharply the work of different authorities. The typographical work is good, the number of errors being exceedingly small. The figures are, as the author states, mostly copies, some of which he has found it necessary to schematise. Except five lithographic plates, they are all wood-cuts (375 in number) and nearly all extremely good.

The subject-matter is divided into chapters corresponding to the classes of Vertebrates. Following the introduction—a short statement of the purpose and scope of the work—is a chapter on the general plan of structure of the vertebrate stomach. The following chapters deal successively with Fishes, Amphibia, Reptiles, etc. Each chapter opens with a general summary of the structure of the stomach in each class, given under the various heads of Epithelium, Muscular Layers, Lymphatic Tissue, etc. Following this the various forms of the class are discussed in their proper systematic order, so far as they have been investigated. Considerable space is also given to a discussion of the physiology of the glands and the constitution of the gastric juice, especially in the higher animals. The chapter on the mammalian stomach occupies somewhat more than half the book and is, of course, much more complete than the other chapters.

As the various points of theoretical interest arise, they are thoroughly discussed, the author in most cases giving his own views after a summary of the literature. An important question, the phylogeny of the gastric glands, is discussed in the first chapter. Oppel concludes that it is by no means proved that the oldest Vertebrates did not possess gastric glands, and that those cases among fishes where they are absent are to be explained through degeneration. The absence of the glands in these forms is thus wholly a secondary modification, as is well shown by the fact that the near relatives of those species in which the glands are absent often possess them in well-developed form. The glands have arisen, not by a deepening and narrowing of the folds of the mucous membrane, but as independent invaginations starting from a very limited area. The absence of gastric glands among the Monotremes, where the whole stomach is lined with a stratified epithelium like that of the œsophagus, is due to secondary changes, the œsophageal epithelium having gradually grown down and displaced the original gastric epithelium.

An exhaustive discussion of the physiology of the mammalian gastric gland-cells is given, and the variety of views held by different authorities shows very clearly the difficulty

of such investigation. The author's conclusion is that the 'central cells' (Hauptzellen) of the fundus-glands are certainly very closely connected with the secretion of the gastric juice. It is very probable that they secrete pepsin, but they may also secrete the hydrochloric acid, though there is no good evidence that they do. The cells of the pyloric glands also probably secrete pepsin. The function of the 'parietal cells' (Belegzellen) of the fundus-glands is not so well understood, but it is probable that they also secrete pepsin. The 'parietal cells' of mammals are by no means identical with the fundus-cells of lower Vertebrates. In closing the discussion he says: "I have emphasized the point that a certain function in one kind of cell does not exclude the possibility of the same or a similar function in another kind." In fact the whole discussion only tends to show how much in the dark we are as regards the actual functions of these cells.

It is impossible to take up the different chapters in detail, as they are so largely summaries of the work of various investigators.

Following the text appears a table of the animals mentioned, arranged according to their systematic position. The classification is in part that followed by Claus in the fifth edition of his 'Lehrbuch der Zoologie.' This table is followed by a list of the same names arranged alphabetically, their systematic position being indicated by the name of the family, order, etc. The next thirty pages are occupied by the literature, and a good index finishes the book. Thus this part is complete in itself as a histology of the vertebrate stomach.

The volume comprises some 530 octavo pages. In reading it one cannot fail to be impressed with the patience of the author, nor to admire the temper of a man who enters single-handed on a subject of such magnitude. It is to be hoped that the work may be carried to completion, for it will constitute a most valuable aid to future research. It is not a book for the general reader, nor is it a text-book, but the student and investigator will find in it a careful resumé of our present knowledge of the histology of the vertebrate stomach. It is, in fact, as the author has said, a key to the literature, and thanks are due to the man who is willing to undertake the so often thankless task of compilation necessary to such a work.

C. M. CHILD.

UNIVERSITY OF CHICAGO.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON; 264TH MEETING. SATURDAY, OCTOBER 24.

DR. ERWIN F. SMITH exhibited specimens of *Leuconostoc mesenteroides* from a sugar house in Louisiana. These were in the shape of fist-large gelatinous aggregates. If the vats are not sterilized at frequent intervals this organism multiplies very rapidly in the sugar cane juice and causes much inconvenience and loss.

Mr. Frederick V. Coville exhibited specimens of the *Hæmatococcus* which is the cause of the so-called 'red snow,' and also the seeds of the Western water lily, *Nymphæa polysepala*. These seeds, in spite of their small size, are an important article of food of the Indians of western Oregon and are extensively collected in Klamath Lake. The seeds are dried and parched in baskets by the use of heated stones.

Mr. C. L. Pollard noted the addition of *Iresine paniculata* to the fauna of the district, specimens having been found on Plummer's Island.

Mr. B. E. Fernow exhibited a series of shrubby and arborescent plants from Arizona, in which many growing points and shoots are changed into spines; the series beginning with *Ceanothus* and ending with *Kœberlinia* and the rare *Holacantha emoryi* showed, with the decrease in the amount and size of foliage, an increase of the number and size of spines, the latter two species consisting entirely of spines, the leaves being reduced to early caducous bracts.

Mr. Albert F. Woods spoke of a plant disease of the foliage of maples, caused by 'red spiders' and excessive atmospheric moisture.

Dr. C. Hart Merriam described a 'New Fir from Arizona,' which he named *Abies arizonica*. It differs from its nearest relative, *A. lasiocarpa*, in the character of the bark, which is a fine-grained cork and in the shape of the cone scales.

Mr. Frederick V. Coville briefly noticed

Britton and Brown's Illustrated Flora of the Northern United States and Canada.

Dr. Erwin F. Smith described a *Bacterial Disease of Potatoes, Tomatoes and Eggplants*, caused by a new micro-organism, *Bacillus solanaceanum*, which he believed to be the cause of a large part of the potato rot of the United States. Numerous infection experiments performed in 1895 and repeated this year have set the parasitic nature of the organism beyond dispute. The following are some of the peculiarities of this bacillus: Organism motile; forms zoögloea in liquid cultures; does not liquefy gelatin; strictly ærobic, does not produce any gas or any acid when grown in the presence of sugars; produces an abundance of alkali (ammonia) in various media; develops a decided brown pigment when grown in the presence of various sugars (agar cultures, fermentation tubes, potato cultures, etc.); grows readily in the thermostat at 37° C.; thermal death point (ten minutes' exposure) about 52°C. The organism is probably transmitted from diseased to healthy plants by means of insects. In the greenhouse, under strict control conditions, very successful infections have been obtained by means of the Colorado potato beetle (*Doryphora 10-lineata*). A bulletin giving a full account of this parasite will soon be published by the Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture.

F. A. Lucas,
Secretary.

ENTOMOLOGICAL SOCIETY OF WASHINGTON, OCTOBER 8, 1896.

The President announced the death of Mr. Henry F. Schönborn, a Washington entomologist, who possessed the largest private collection of Lepidoptera in the city.

Mr. Ashmead exhibited a female specimen of the family Thynnidæ which he had found in the National Museum collection labelled 'Alameda County, California.' This is the second North American species of this family recorded from America. Mr. Ashmead will call it *Glyptometopa americana*. Some discussion ensued and it was suggested that both species had been accidentally imported into America.

Mr. Heidemann exhibited a drawing of the winged male of *Rheumatobates rileyi*, showing that the description of the species must now be revised.

Mr. F. C. Pratt exhibited specimens of the spine-like cases of *Coleophora octagonella*, taken from orange, and which exactly resembled the thorns of orange.

Mr. Hubbard presented a preliminary notice of a new Coccid on birch from the Lake Superior region. This insect is very abundant and causes the general destruction of the bark of birch trees, so much so that it is difficult to find near the Lake a tree of any size with smooth or natural bark. The outer bark is roughened, covered with curls and splits, blackened with sooty mold, and in bad cases entirely removed down to the last layer. Often the cambium itself is invaded and the tree is killed or seriously injured. The young larva of the Coccid crawls into the lenticels of the bark and, growing and forming thick masses of wax, causes the bark to heave and layers to separate in curls. He had studied the development of the species, which exhibited several remarkable features. The female undergoes three molts and has four stages, of which the larva and adult are active and possess legs and antennæ. The two intervening stages are stationary and degraded. The author considers the species to belong in all probability to the genus *Xylococcus*.

Dr. M. G. Motter presented a paper entitled 'A Contribution to the Study of some Necrophagous Diptera,' giving a preliminary announcement of some results of his study of the fauna of cadavers which he has been carrying on for some months with a view of substantiating or contradicting conclusions of Mégnin and other writers.

L. O. Howard,
Secretary.

NORTHWESTERN UNIVERSITY SCIENCE CLUB.

At the first meeting of the college year, October 9th, Dr. Marcy in the chair and eighteen persons present, Prof. Young presented for the department of chemistry 'Notes on the Development of Explosives,' in which he reviewed the processes of explosion and the nature and use of explosives.

A. R. Crook,
Secretary.